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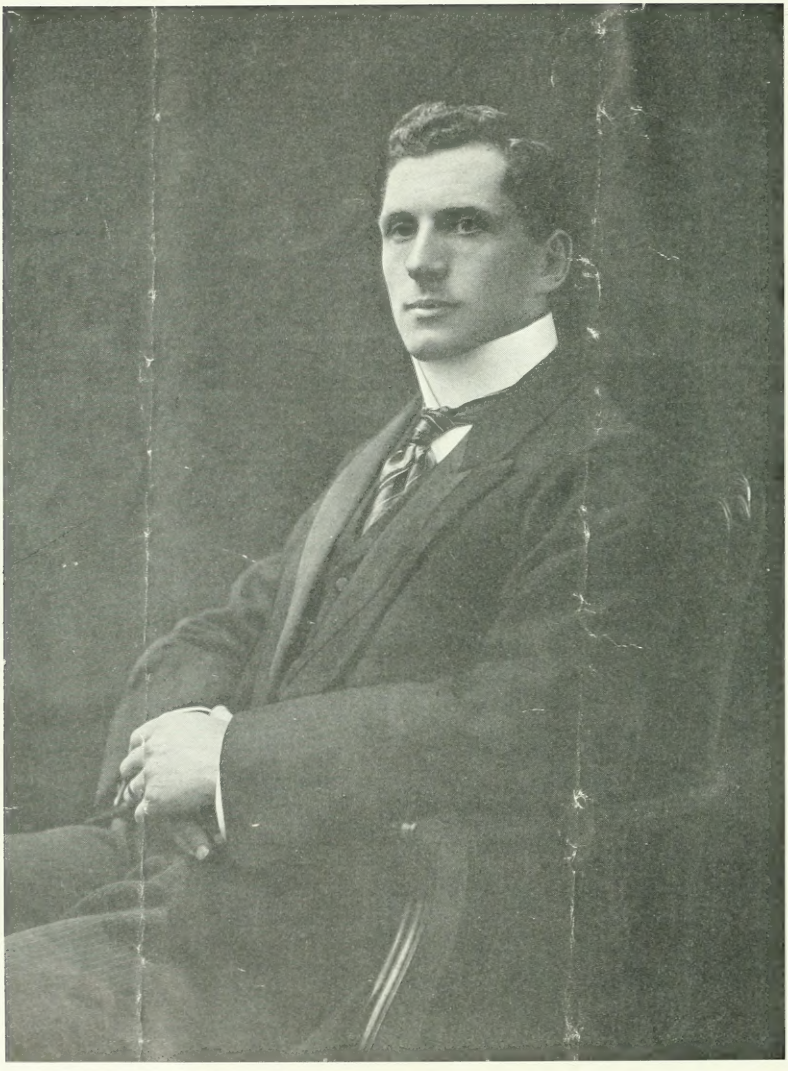

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The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

Municipal Engineering War-time Appointments.

The paragraph with this sidehead in our last issue has apparently found favour, and we direct attention to a selection elsewhere of some of the correspondence it has invited. We have now at the service of local authorities who have engineering staff appointments to fill a list of applicants willing to apply for such vacancies, with, in each case, a brief preliminary indication of the candidate's qualifications. We shall be pleased to send a copy of this to any authority which applies for it.

* * *

The Annual Meeting.

Despite the forebodings due to the war, there was a record attendance at the annual meeting of the Institution of Municipal and County Engineers, and this, and the excellence and variety of the papers, ensured a highly successful meeting. The admirable address with which the president, Mr. H. T. Wakelam, M.INST.C.E., the county engineer of Middlesex, opened the meeting was, as one would expect from an engineer of so long and wide an experience, of the greatest practical value. His advice to young engineers to take as a model two or three of the most successful practitioners and follow their example, and to add to a good theoretical training the practical experience which comes from intelligent observation and the inspection of works during construction, was both sound and timely. Young engineers should never miss an opportunity of inspecting engineering works during their construction, for the knowledge of the practical details on which all sound engineering depends can be obtained in no other way. Initiative, tact, and capacity for hard work are the qualities required in the young engineer, and to these the president rightly adds the necessity for a constitution which will stand all climatic conditions and physical and mental strain. Too many young fellows of a studious turn of mind are apt to overlook the importance of a good physique; and frequently a student has found that "burning the midnight oil" has led to a physical deterioration which has wrecked his future career. A reminder to young engineers that it will take years of practical experience to give value to their theoretical training is very necessary in these days when engineering classes are so general. In nearly all our large towns well-equipped physical and engineering laboratories are to be found; and there is a danger of the student thinking he will step out of them a fully experienced and equipped engineer. The great engineering works of the past, and especially of the nineteenth century, the housing of the working classes, the introduction and improvement of the motor car and its effect on our roads were all briefly touched upon. Coming from an engineer who has charge of so important a class of roads, the address dealt at some length with the need for greater thought and consideration of road makers. The need for planning arterial roads as an indispensable part of town planning, and indeed prior to the general scheme of town planning, was clearly laid down. Town planning embraces many other things than roads, but the lay-out, the width and character of the arterial roads, is the first, as it is probably the most important, part of the majority of town planning schemes. The need for new road materials, classification of roads, and the better regulation of motor traffic were all touched upon; but as these matters were subsequently to be dealt with in papers, they were only briefly considered.

* * *

The Papers and Discussions.

Three of the papers read at the meeting dealt with the subject of mechanically propelled vehicles for municipal work. As the authors were able to speak with an experience gained in a metropolitan borough, a large sea-side town, and an agricultural county, the papers are extremely useful, and appeal to a wide circle of municipal engineers. The use of motor vehicles for municipal purposes is undoubtedly extending, though not so rapidly as many people expected. The natural conservatism of our local bodies and their advisers makes them "shy" at innovations, and we rarely adopt anything until the novelty is worn off. This ultra-cautiousness prevents us making any great mistakes, but it does leave us now and again woefully behind the times. While there can be little doubt that many more towns and counties could adopt motor vehicles with great advantage and economy, it must also be recognised that motor vehicles cannot be used successfully in all situations. For long distances and heavy loads, coupled with continuous usage, they will no doubt drive horse traffic off the roads; but there are places where horse hire is extraordinarily cheap—Belfast until recently only paid 5s. per day for team labour—and when, as is frequently the case, difficulty is experienced in keeping a motor vehicle in constant work, the latter is not likely to supplant the horse-driven vehicle.

In some notes on sewage treatment by forced aëration the city surveyor of Wakefield, Mr. J. P. Wakeford, dealt with a subject of great interest to municipal engineers. The use of forced aëration, as the author admitted in his paper, is not new, but its application in the form of "activated sludge," as

developed by Dr. Gilbert Fowler, of Manchester, is still somewhat of a novelty. A most interesting and animated discussion took place on this paper, and though a certain amount of scepticism was shown with regard to the economic features of the scheme, and as to the successful working of the engineering details, on the whole it was considered to be an advance in the right direction. As with many other systems, it appears to have been successful in several places, while at others difficulties have been met with which have led many engineers to class it with those other schemes which were to settle the sewage problem, but which are now relegated to the limbo of forgotten things. "Some Recent Experiences in the Surfacing and Maintenance of Roads," by Mr. J. A. Webb; "Notes on the Preparation and Laying of Tar-macadam on Roads in Bedford," by the borough engineer, Mr. Greenshields; "The Improvement and Maintenance of Highways," by Mr. C. F. Gettings and Mr. J. S. Brodie; "Reinforced Concrete for Roads, Sewerage, &c.," by Mr. A. E. Collins; with a paper on "Tar, Pitch and Bitumen in Road Construction," by Mr. Dryland—all dealt with a subject of perennial interest, and led to most useful discussions. Mr. Isaac Shone's interesting paper describing his new system of drainage; the description of the Kingston sewage works by Mr. R. H. Clucas; "Trench Openings," by Mr. R. Brown; "Fire Brigade Organisation and Equipment," by Mr. W. A. Farnham; and "The Protection of Ancient Buildings," by Mr. W. A. Forsyth, F.R.I.B.A., were all interesting papers, to which we hope to return in a future issue. It only remains to add that the president conducted the meeting with an admirable blend of courtesy and firmness, and the hospitality which he showed to the members and their friends did much to make a complete success of the meeting.

* * *

The London County Council Tramways.

The accounts for 1914-15 of the London County Council tramways, which were submitted to the council at Wednesday's meeting, show how seriously the earning power of that undertaking is being affected by rival transport services and other conditions. In some respects the figures are an improvement on those of the preceding year, but the final result is a deficiency of £33,172. This has had to be met out of the general reserve fund, which has in consequence been reduced to £163,050. Nothing, of course, could be added to the renewals fund, which on March 31st stood at £402,045. Working expenses include war service allowances to employés serving with the forces, amounting to £42,209. Gross passenger receipts amounted to £2,323,130, compared with £2,181,344 in 1913-14, and the number of passengers carried was 550,497,993, against 522,952,640. Receipts in respect of electric traction improved from 9·21d. to 9·77d. per car mile, but working expenses also increased—from 6·50d. to 6·71d.

As regards the current financial year, the Highways Committee originally estimated that the total working surplus would amount to £680,620, and the debt and other charges to £772,234, leaving a net deficiency of £91,614. In order to make this good, the reserve fund would be further reduced to £99,968. The committee pointed out, however, that but for the provision of £50,000 for contingencies—against £10,000 last year—and the cost of war service allowances, calculated at £81,000, there would be an estimated surplus of £39,386, despite higher working costs and the rise in the price of materials. Since the estimates were framed events have occurred which must have the effect of adding heavily to the deficiency. The recent strike will probably result in a net loss of £100,000, and the extension of the war bonus grants to employés will involve additional unforeseen expenditure. "Whilst, therefore," remarks the committee, "the estimates anticipated that at March 31st, 1916, there would be a sum of nearly £100,000 in the general reserve fund, the additional charges above mentioned, and the increased deficit for 1914-15, threaten to exhaust the fund before the end of the year, and there may be an amount still left to be found from some other source." The committee therefore view with concern the probable financial results for the current financial year, having regard to the heavy additional charges on the undertaking and loss of traffic revenue owing to the war and the strike. It has to be pointed out, however, that within a few years' time the financial position will benefit considerably by reason of the reduction in the annual charge in respect of interest on debt. The total debt incurred up to March 31st last was £13,744,806, and the amount outstanding on that date was £9,836,187. As provision for the repayment of the whole of the tramways debt is being made on the system of equal instalments of principal, and most of it within twenty-five years, there is a sensible diminution each year, apart from fresh borrowings, in the charge for interest.

* * *

Superannuation.

Although it would be difficult to imagine a more unfavourable time than the present to urge the undoubted claims of municipal officers to the benefits of superannuation, we may perhaps be permitted to refer shortly to that part of the annual report of the council of the Institution of Municipal and County Engineers for 1914-15 which deals with this important subject. It has long been recognised that if the desired end is to be attained it must not be sought independently by bodies representing different sections of officials, but embodied in a comprehensive measure of general application. Hence the active part which has been played in the matter by the National Association of Local Government Officers. It will be remembered that just prior to the commencement of the war an influential deputation waited upon the President of the Local Government Board, and received a very favourable hearing. Mr. Herbert Samuel in his reply admitted the inconsistency of the present method of dealing with superannuation for local government officers, and expressed his own opinion that the case presented by the National Association was a very strong one indeed. He therefore promised, as the outcome of the deputation, to draw up a statement of the present position with regard to local government officers, and to communicate with the great organisations that represented local authorities—*i.e.*, the Association of Municipal Corporations, the County Councils Association, the Urban District Councils Association, and the Rural District Councils Association. Very little time was lost by the President of the Local Government Board in communicating with these organisations, and at the time of writing the first three have given favourable replies, and the Rural District Councils Association will deal with the matter at their next annual meeting. It is assumed that immediately the President of the Local Government Board has received the last reply he will set up a special committee to deal with the question. It is to be regretted that the outbreak of war has, for the time being, diverted the attention of the Local Government Board and local authorities from this important matter, but officials can still help by supporting the National Association and endeavouring to influence the members of their authorities.

* * *

Electrolytic Disinfectant.

It is now some nine years since the manufacture of electrolytic fluid disinfectant was first undertaken by the public health department of the Poplar Borough Council, the plant having been originally installed in 1906. From a report which has just been issued it appears that since that date as much as 381,794 gallons of fluid have been manufactured at a cost of less than one halfpenny per gallon. At the present time, in addition to the public distribution of the fluid from several centres in the borough, a supply is maintained for the use of

the public health department, and for the various institutions of the borough council and board of guardians, in addition to certain elementary schools. We have on former occasions referred to the value of the fluid for the treatment of the water in public swimming baths. Dealing with this subject, a committee of the Royal Sanitary Institute reported in 1912 that they were very much impressed by the good results that had been obtained. By the addition of hypochlorite of magnesia solution to the pond water, in amount sufficient to give one part of free chlorine to every one or two million parts of water, not only is the water sterilised, or deprived of all organised living molecules, but it is kept sweet and free from odour, and there is no tendency in the water to the deposition of slimy sediments on the floor of the pond. A certain amount of slimy matter collects on the walls of the pond at the line where the surface of the water is in continual movement from the undulatory motions induced by the movements of the bathers, but this is readily removed with a swab by an attendant. It should be said that the electrolytic fluid in the Poplar baths is not used with the idea of rendering unnecessary periodic changes of the pond water, but to keep the water in the pond fresh and free from harmful organisms all the time it is in use. The class of persons who use the swimming ponds in Poplar is always likely to contain uncleanly or infected individuals, and it is to guard against danger from the latter that the fluid finds its chief application.

* * *

Public Baths and Cinematographs.

The letting by the Shoreditch Borough Council of their public baths, in which they had previously installed an operating box, for the purposes of a cinematograph entertainment gave rise recently to an action in which some interesting questions as to the powers of local authorities under the Baths and Washhouses Acts were introduced. The action was brought by the Attorney-General at the relation of the Hoxton Cinema, Limited, and a declaration was claimed that in so letting the baths the borough council were acting beyond their powers. Recognising that swimming baths "as such are practically not required during the winter months, the Act provides that during that period they may be used "as empty buildings" for any purpose of healthful recreation or exercise. The Court of Appeal, in granting the declaration asked for, rested their decision largely upon the ground that, having installed an operating box, which is a solid cement structure, the borough council could not be said to have let the bath as "an empty building." Other questions arising out of restrictions which the Act imposes on the use of baths for purposes of music or dancing were discussed, but the point as to whether or no a cinematograph entertainment is within the meaning of the words "healthful recreation or exercise," as used in the Act, does not appear to have been directly determined. In considering this question, it must be remembered that the cinematograph was not invented until long after the Act was passed, and that it cannot therefore have been directly within the contemplation of the Legislature. The real question raised by the case, however, is as to whether the restrictions imposed by the Act are not rather out of date, and whether, in view of the loss at which these establishments are almost invariably run, they cannot reasonably be either removed or modified.

* * *

The Darwen Borough Surveyorship.

The large ratepayer has sometimes a very small mind, and a specimen of such we should imagine is he who wrote recently to the *Darwen Gazette* with reference to the office of borough surveyor. It is above the *nom de plume* "Large Ratepayer" that this gentleman offers some suggestions to the Darwen Corporation on the subject of the vacant borough surveyorship and the best means of filling it with due regard to economy. His first proposal is that "an entirely total stranger to Darwen" should receive the appointment. It is manifest that "Large Ratepayer's" feelings have been deeply stirred by his subject, else he would hardly have written with such adverbial and adjectival emphasis. But it is not enough that the new borough surveyor should be a complete stranger in a strange land. It is also insisted that he should receive "not more than one-half salary the late surveyor was receiving," a suggestion that is amiably qualified with the hint that "less than that is reasonably and practicibley possible." It is in such vein, tempered with a number of other suggestions that go to prove that what he desires is not so much the appointment of a competent professional man as an individual of unproved capacity and dependence, that "Large Ratepayer" displays the largeness of his prejudices and the totality of his ignorance on professional appointments. To quote his own decorative figure, we should say that not one of his suggestions is either reasonable or "practicibley" possible.

* * *

A Contractor's Action.

An action of some interest to municipal engineers was tried at the recent Essex Assizes, when the Harwich Corporation were sued by a contractor who claimed a sum of £266 as balance of account for work done and materials supplied under a contract for the erection of a groyne and landing-stage on the foreshore at Dovercourt. The work was to be executed in reinforced concrete, to the designs of a specialist; and the allegation of the plaintiff was that he had been compelled to abandon the work, as it was physically impossible to carry it out owing to the exposed position of the groyne and the direction of the prevailing winds. To this the defendant corporation replied that no difficulty would have arisen if the contract had been completed at the proper time—namely, by August 31st. The contractor explained the reason for the delay, and alleged that the surveyor had verbally agreed to an extension of the time-limit. The case was not tried to a conclusion, as an arrangement was come to between the parties in the course of the hearing by which judgment was entered for the defendants on the claim, and for the defendants for £50 on the counter-claim. In giving effect to this arrangement Mr. Justice Low said that so far as he could see the Corporation of Harwich had acted with perfect propriety in the matter, especially having regard to the fact that they were in the position of trustees for the ratepayers' money.

* * *

Compulsion.

We observe with some surprise that the Corporation of the City of London have decided not to increase during the war the wages of any of their employees of military age. A perusal of our columns since the outbreak of war in August last will show at once that we have done all in our power to urge our younger readers to offer themselves for the service of their King and country in this great national emergency, and that we have on more than one occasion made suggestions for preserving their chances of promotion and otherwise for protecting their interests while they are away. Nevertheless, it must be remembered that, rightly or wrongly, the country is still relying upon the principle of voluntary service, by which the great decision must be left to the conscience of the individual. This being so, the only legitimate method of influencing those who remain behind is that of persuasion—as opposed to direct coercion or, what amounts to much the same thing, the imposition of a penalty. If compulsory service is necessary for the national salvation, by all means let us have it; meanwhile we take leave to enter a protest against action of the kind taken by the City Corporation—apparently without discrimination.

The Adequacy of Bituminous Roads.*

By G. H. JACK, County Surveyor of Herefordshire.

The adequacy of bituminous roads depends to a great extent upon the local conditions affecting the stability of the subsoil and facilities for drainage. There are, of course, other factors inseparable from the nature of the materials themselves and the method employed in applying them. For instances, take the three best-known forms of surfacing—viz., tarmac, tar-macadam, and tar-grouted macadam. Whatever other influences there may be at work, the widely different behaviour of these three forms, provided each is laid on a good foundation, is largely due to the degree of density procurable. In all cases where broken stone or slag is used, whether water or tar bound, it is always noticeable that the quantity of binder taken up by the coating varies considerably, due to the space between the stones being greater in one spot than another. It is quite impossible, therefore, to expect in the case of tar-grouting an even distribution of the binder. As a consequence, all tar-grouted roads soon show harsh patches, which become loose and troublesome under a moderate traffic.

If the texture of the road varies, the wear must under the roller, which gives a hard and compact result; such work is practically waterproof and therefore durable, but, unfortunately, rather slippery under certain climatic conditions. Slipperiness, however, is an accompaniment of all the best-known surfacing methods; the difficulty, though troublesome, can be surmounted, except, perhaps, upon steep hills.

CORRUGATIONS.

Another much-discussed trouble is that associated with the appearance of corrugations, particularly noticeable in modern road surfaces. There appears to be very little, if any, vertical displacement upon roads paved with wood or setts, but it is noticeable that, after such roads have been subjected to the traffic, the lines of the blocks are sometimes pushed into curves, obviously by the traffic itself. Naturally the displacement of the material, both longitudinally and vertically, is much more noticeable when the road is built up with more or less plastic materials. I have often noticed that the more yielding the binder the more wavy the surface becomes. The corrugations

TABLE SHOWING COSTS OF SURFACES AND FOUNDATIONS.

The thickness of the surface in each case is 3 inches. The cost per mile is for roads 6 yards in width.

Description.		Surface.			Foundation.		
Surface.	Foundation.	Haulage distance. Miles.	Cost per square yard.	Cost per mile.	Depth.	Cost per square yard.	Cost per mile.
			s. d.	£	Ft. in.	s. d.	£
Limestone grouted with Westrumite asphalt.	Waterbound limestone.	½	1 2	616	0 6	1 9½	949
Clee Hill tarmacadam.	Waterbound Clee Hill basalt.	7½	2 1·6	1,127	0 3	1 2·3	628
Clee Hill basalt grouted with Keys bituminous Compound "D."	Waterbound limestone and slag.	1½	2 8·7	1,430	0 6	1 7·2	668
Gore basalt waterbound with "Vranes" and flushed with "Camarco" asphalt.	Waterbound limestone, slag and granite.	2	1 7·5	857	0 0–3 6	1 9·4	944
Gore basalt grouted with "Camarco" asphalt in trouble, Lime stone waterbound with "Vranes" in strips.	Waterbound limestone, slag and basalt.	2½	2 0·4	1,075	0 5	1 4·6	732

necessarily vary, and although patches of roadway may remain quite good, other and adjacent patches are undoubtedly bad. As soon as this condition arises recourse is usually had to surface-tarring, which heals the sores for a time, but does not remedy the fundamental defect. It is the same, to a much lesser degree, with tarred macadam, although still less so when limestone is employed as against granite, for the reason that in the process of rolling the limestone crushes somewhat, and thus reduces the spaces between the stones; whereas the granite does not crush, and so the spaces remain unless the stone is very efficiently covered with a compound having a high viscosity. Tarred granite roads, where the stone is mixed with crude tar, are often failures for the reason that the tar does not fill the interstices; the stone becomes dry, and the surface soon loose and friable.

In the case of tarmac the interstitial space is reduced to a minimum, partly by reason of the properties of the slag and partly because it crushes slightly

* Extracts from paper read at the opening sitting of the National Road Conference on Monday.

are no doubt partly due to the rolling in the first place, but to a much less extent than the subsequent rolling and pushing action of the traffic. The trouble is certainly not entirely due to the steam rolling, which is proved by the wavy appearance of hand-laid asphalt surfaces. It seems to me that all roads constructed of materials which have not the rigidity of granite setts or wood blocks, or lack the elasticity of such a material as rubber, must develop corrugations as a matter of course.

The wear and tear of roads due to ordinary traffic is eclipsed by the extraordinary punishment inflicted by heavy motors and traction engines carrying illegal weights at excessive speed. When such damage is pointed out and resented, the answer given is usually to the effect that if the roads are not strong enough to bear any traffic likely to be brought upon them they ought to be made so. Provided one knew what the weight and speed of the traffic was likely to be, the difficulty in designing new roads would vastly decrease. It is just this uncertain factor which is so perplexing. No one would think of doubling weight

and speed upon the railways without materially strengthening the track and bridges at enormous cost, but when our highways are subjected to such usage, for which they were never designed, surprise is expressed in some quarters at the manner in which they rapidly give way under the strain.

I have seen new bituminous roads in this county soon after completion most seriously damaged by engines weighing anything up to 15 tons (though registered as 10 tons) drawing heavy vans, each with one wheel equipped with a badly adjusted brake slipper.

While it would be absurd to infer that commercial traffic upon the roads must be penalised because the existing roads are not designed to carry mechanical traffic, it would be equally fallacious to imagine that old roads can be reconstructed or new roads designed unless fairly accurate data is at hand as to what weight and speed of traffic the roads are to be called upon to sustain. This means that a reasonable limit must of necessity be assumed by those responsible for the design of the roads.

I trust the committee recently appointed by the Local Government Board will be able to make such acceptable recommendations as will both simplify the existing somewhat hazy state of the law and define clearly what traffic (if any) is to be considered illegal.

An effort has been made in Herefordshire to obtain road surfaces superior to water-bound basalt at a reasonable cost. The attached schedule indicates what has been achieved. The life of the new roads has yet to be proved. It will be noticed that Cleetar-surfaced roads, 6 in. in thickness, have been laid at 3s. 3d. per square yard. The wear apparent after two years is very slight.

Some further particulars in reference to the Westrumite section may be of special interest. This material has the advantage of being laid cold. The grouting is done in two operations—the first is by means of very thin material (3 parts water to 1 part asphalt), which penetrates well; the second is very much thicker (1 part water to 3 parts asphalt mixed with ½ in. to dust limestone). This forms the sealing coat, which is sprinkled with fine limestone dust. The total thickness of this was 8 in.—foundations 5 in., surface 3 in.—the cost per square yard 2s. 11½d., of which 1s. 9½d. is attributable to foundations.

REINSTATEMENT OF TRENCHES.

PRICES IN THE METROPOLITAN AREA.

At last Friday's meeting of the Metropolitan Water Board the Works and Stores Committee reported that applications had been received from certain local authorities for the approval of prices in respect of the reinstatement of trenches opened by the board within the respective districts.

The committee having been advised that the proposed prices were reasonable, recommended—

(*a*) That the undermentioned alterations or additions to the schedules of prices agreed to be paid in respect of the reinstatement of trenches opened by the board within the undermentioned districts be approved—viz.:—

METROPOLITAN BOROUGH COUNCIL OF HACKNEY.

	s.	d.	
Tar-paving	3	0	per super. yard.
„ macadam	7	0	„
Asphalt ...	6	6	„
„ roadway	12	0	„

ACTON URBAN DISTRICT COUNCIL.

	s.	d.	
New blue-brick paving ...	5	9	per square yard

METROPOLITAN BOROUGH COUNCIL OF FINSBURY.

Footway Paved by Val de Travers.

Mastic asphalt, at per yard super., 1 in. thick:—

	Previous price. s. d.	Proposed price. s. d.
Up to and including 5 yards super. ...	4 9	... 5 0
Above 5 yds. up to and including 10 yds.	4 6	... 5 0
„ 10 „ „ „ 20 „	4 3	... 4 6
„ 20 „ „ „ 50 „	3 9	... 4 3
„ 50 „ „ „ 100 „	3 9	... 4 0

Concrete by council at 18s. per cubic yard.
Footway nearly always on 4-in. concrete.
Nothing less than 1 yard.

Asphalt Roadway paved by Val de Travers, Limmer or French, whichever is nearest the opening.

Proposed prices for compressed asphalt at per yard super.:—

	1-in. thick. s. d.	1½-in thick. s. d.	2-in. thick. s. d.
Up to and including 5 yds. super.	7 0	...10 6	...13 0
Above 5 yards up to and including 10 yards	6 6	...10 0	...12 6
„ 10 „ „ 20 „	6 6	... 8 6	..12 0
„ 20 „ „ 50 „	6 3	... 8 0	...11 0
„ 50 „ „ 100 „	6 0	... 8 0	...10 0

Concrete by council at 18s. cube yard.
Nothing less than 1 yard.

HENDON URBAN DISTRICT COUNCIL.

	s.	d.	
Wood and concrete	19	0	per yard super.
Wood only	11	6	„ „
Concrete only...	7	6	„ „
Relaying setts on 6 in. concrete	6	0	„ „
„ „ 9 in. concrete	7	6	„ „
„ „ 12 in. concrete	9	0	„ „
Brick paving	4	0	„ „

WOODFORD URBAN DISTRICT COUNCIL.

	s.	d.	
Trinidad asphalt and Bituvia	15	0	per yard super.

EAST HAM CORPORATION.

	s.	d.	
Asphalt macadam	6	6	per square yard
Pitchings relaid on 9 in. concrete	8	6	„ „
Concrete	20	0	per cubic yard
Channelling relaid	1	10	per yard run
Tar-macadam, with topping	5	0	per yard super.

ILFORD URBAN DISTRICT COUNCIL.

	s.	d.	
Asphalt	3	0	per yard super.
Tar paving	3	0	„ „

METROPOLITAN BOROUGH COUNCIL OF CAMBERWELL.

	s.	d.	
Tar-macadam	1	6	per yard super.

METROPOLITAN BOROUGH COUNCIL OF ST. PANCRAS.

	s.	d.	
Tar-sprayed macadam ...	3	0	per yard super.
New wood blocks ...	... cost price.		

(*b*) That an addition of 10 per cent on the schedule of prices agreed to be paid to the Metropolitan Borough Councils of Stepney and Poplar in respect of the reinstatement of trenches opened by the board within the respective districts, as from April 1, 1915, be approved.

(*c*) That the revised schedule of prices submitted by the Westminster City Council and now laid upon the table, in respect of the reinstatement of trenches opened by the board within the council's area, be approved.

(*d*) That, in consideration of the Hendon Urban District Council relieving the board of the duty of reinstating trenches opened by the board within the Hendon Urban District, the board do agree to make an additional payment of 5 per cent in respect of supervision on accounts rendered by the district council for such reinstatement, subject to the completion of an agreement between the council and the board providing for the termination of the arrangement on three months' notice on either side, and that the clerk of the board be authorised to sign all necessary documents.

A Glossary of Road Terms (By H. Percy Boulnois, M.INST.C.E., St. Bride's Press, Limited, 24 Bride-lane, E.C., Price 2s. nett).—The movement towards standardising the principal roads throughout the United Kingdom has rendered it necessary to correlate the nomenclature of road terms in use in different districts, and Mr. Boulnois has compiled a glossary with the hope that it may form a basis for such a correlation.—*Times Engineering Supplement.*

Chorley Water Supply.—The Liverpool Corporation Water Committee paid a visit of inspection recently to the Rivington watershed, and at the Chorley filter-beds, Crosse Hall-lane, the formal opening took place of a new clear-water reservoir, which has been in process of construction since September last. The reservoir is built of concrete and is covered in. It has a holding capacity of 330,000 gallons, being 83 ft. long by 63 ft., and 10 ft. high. The cost has been £3,500.

Haulage by Mechanical Means.*

By T. W. E. HIGGENS, assoc.m.inst.c.e., Borough Surveyor of Chelsea.

The original estimates, both as to price and horse-power, put forward by the pioneers of mechanical traction when the Motor Car Act of 1896 was being prepared, have not yet been realised. In October, 1895, the author was offered an 8-h.p. motor dust van for £320, and was subsequently informed that, as 6-h.p. was probably more than was required, he could have a 4-h.p. motor for £160; but even this power was a little more than was necessary, as the roads in his district were flat and even.

The experience of twenty years has shown that about 40-h.p. is required for an efficient municipal motor van, and a price of £550 is not excessive.

In March, 1898, the local authority in Chelsea (then the Chelsea Vestry) hired a motor dust wagon from Messrs. Thornycroft for a few days, to see whether such a vehicle could be used in London streets with advantage, and as the result proved satisfactory orders for three motor vehicles were shortly given, and motor vans have been used in Chelsea for municipal purposes since 1900.

In February of that year a Thornycroft steam tip wagon, with both cartage body and watering tank, was purchased second-hand from the makers for £550. In August two Leyland steam wagons were purchased for £950. In September, 1903, two Leyland steam wagons, with both cartage bodies and watering tanks, were purchased for £1,136. In June, 1905, a similar vehicle was purchased for £565. In 1906 ten Leyland steam motors, five of which had watering tanks in addition to the cartage bodies, were purchased for £5,550. In all cases the vehicles were purchased out of current revenue, and not by means of a loan. In addition to the above vehicles, a Leyland vacuum tank wagon has been hired from the makers since 1911 for cleaning out street gullies.

The author submits a statement showing the cost of working the sixteen motors during the last seven years.

* Paper presented at the annual meeting of the Institution of Municipal and County Engineers in London last week.

The one purchased in 1907, for £60 per annum for the first two years; for £75 per annum for the third year; for £60 per annum for the fourth, fifth, sixth and seventh years; for £40 per annum for the eighth, ninth, tenth, eleventh, twelfth, thirteenth and fourteenth years, after £200 had been spent on rebuilding each of them in the eighth year.

The two purchased in 1903, for £60 per annum for the first four years; for £40 per annum from the fifth to the eleventh year, a sum of £150 being spent on each of them in the eighth year.

The one purchased in 1905, for £60 per annum for the first two years; for £40 per annum from the third to the tenth year, a sum of £150 being spent on it in the seventh year.

The ten purchased in 1906, for £40 per annum during the nine years.

The other item of "Repairs" is mostly for the Thornycroft motor, which was repaired from time to time, but not under contract until 1911, when a local firm undertook the work. The cost from this date is included under "Contractor's maintenance." This motor was put out of use in the middle of 1913.

Since 1911-12 the vacuum gully-cleaner's working expenses are included in the accounts.

In 1908 a statement was prepared showing the estimated cost of the first Leyland motor for eleven years' working, and it is interesting to compare it with the costs shown in the detailed statement of seven years' work of the sixteen motors:—

	£	s.	d.
Original cost	475	0	0
Maintenance first and second year at £57 per annum	114	0	0
Maintenance third year at £75	75	0	0
Maintenance fourth, fifth, sixth and seventh year at £60 per annum	240	0	0
Maintenance eighth, ninth, tenth and eleventh years at £40 per annum	160	0	0
Thoroughly overhauling at end of seventh year	200	0	0
Fuel, &c., at £50 per annum	550	0	0
Driver's wages, 38s. weekly (£98 16s. per annum)	1,086	16	0
Driver's insurance (Workmen's Compensation Act, 7s. 6d. per annum)	4	2	6
Driver's licence (5s. per annum)	2	15	0
Registration of motor	1	0	0
Insurance of boiler (£1 4s. per annum)	13	4	0
11)	£2,921	17	6
	£265	12	6

Cost of Working Sixteen Motor Vans.

—	1907-8.			1908-9.			1909-10.			1910-11.			1911-12.			1912-13.			1913-14.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Contractors' maintenance	627	10	0	600	0	0	600	0	0	647	10	0	636	6	9	614	16	5	623	15	0
Coal, coke, wood	560	6	0	539	8	1	434	9	11	526	8	10	587	15	3	573	0	1	612	0	5
Oilman's goods	218	18	8	176	18	8	165	13	9	148	11	7	161	8	0	164	17	4	178	19	4
Packing, &c.	—			14	14	11	9	2	9	14	0	7	12	5	9	8	12	6	4	2	8
Ironmongery	9	8	6	13	8	11	18	0	6	13	16	2	9	19	2	10	8	11	16	5	0
Repairs	63	11	8	44	11	3	28	16	9	10	13	6	125	19	0	2	1	0	0	2	6
Coke sacks	3	12	0	10	10	0	5	10	0	4	0	0	11	16	6	13	17	0	—		
Drivers' licences	8	10	0	8	0	0	7	15	0	7	10	0	7	10	0	7	5	0	7	5	0
Insurance	29	15	3	19	4	0	19	4	0	19	4	0	22	4	3	22	4	3	22	0	0
Wages	2,546	16	10	2,016	8	10	2,205	4	9	1,994	12	0	2,041	12	0	1,931	7	7	1,939	3	0
New parts	—			25	15	0	12	7	6	—			—			—			—		
Sundries				1	0	0	—			—			—			—			—		
Rebuilding	—			400	0	0	—			—			—			450	0	0	—		
	4,068	8	11	3,869	19	8	3,506	4	11	3,386	6	8	3,616	16	8	3,798	10	1	3,403	17	2
Average cost for each motor	254	0	0	216	0	0	220	0	0	216	0	0	226	0	0	209	0	0	194	0	0
Cost, less wages of drivers, &c.	95	0	0	90	0	0	81	0	0	87	0	0	98	0	0	89	0	0	77	0	0

As regards the item "Contractor's maintenance" in the foregoing statement, the fifteen Leyland motors were maintained by the makers at annual contracts, as follows:—

The two purchased in 1900, for £57 per annum for the first two years; for £75 per annum for the third year; for £60 per annum for the fourth, fifth, sixth and seventh years; for £40 per annum for the eighth, ninth, tenth, eleventh, twelfth, thirteenth and fourteenth years, after £200 had been spent on rebuilding each of them in the eighth year.

The two purchased in 1903, for £60 per annum for the first four years; for £40 per annum from the fifth to the eleventh year, a sum of £150 being spent on each of them in the eighth year.

The one purchased in 1905, for £60 per annum for the first two years; for £40 per annum from the third to the tenth year, a sum of £150 being spent on it in the seventh year.

The ten purchased in 1906, for £40 per annum during the nine years.

The other item of "Repairs" is mostly for the Thornycroft motor, which was repaired from time to time, but not under contract until 1911, when a local firm undertook the work. The cost from this date is included under "Contractor's maintenance." This motor was put out of use in the middle of 1913.

Since 1911-12 the vacuum gully-cleaner's working expenses are included in the accounts.

A statement has been prepared showing the cost of collection of house refuse by horses and vans for six years viz.:—

Year.	s.	d.	
1901-2	4	11	per ton.
1902-3	4	9	,, ,,
1903-4	4	11	,, ,,
1904-5	4	8	,, ,,
1905-6	4	9	,, ,,
1906-7	4	10	,, ,,

A similar service by means of motor vans for the last four years is as follows:—

Year.	s.	d.	
1910-11	4	5	per ton.
1911-12	4	5	,, ,,
1912-13	4	7	,, ,,
1913-14	4	6	,, ,,

In order to show the actual working expenses of

motors in use for dust collection, the detailed cost of working two Leyland motors during three quarters of last year is submitted.

London, he is bound to draw attention to the fact that [illegible] and counties subject to snow-falls, the skidding of smooth, iron-tyred wheels may

Statement Showing the Cost of Two Motors used for Removing House Refuse during the Last Three Quarters of Last Year was as follows:—

No. 2 Motor.

1914-15.	Dust collected.	Coke.	Bundles of wood.	Cylinder oil.	Paraffin.	Lard oil.	Boiler fluid.	Cotton waste.		
	T. c. q.	T. c. q.		pts.	pts.	pts.	pts.	lb.		£ s. d.
June qr.	391 0 1	5 8 2	402	400	18	6	28	1		
Sept. qr.	466 11 1	5 18 0	456	464	22	2	38	4		
Dec. qr.	480 11 0	6 6 2	462	416	24	3	30			
	1,338 5 2							5	at 27/- per cwt	0 1 3
							96	12 gallons at 2/6		1 10 0
						11	1½	gallons at 2/5		0 3 4
					64	8 gallons at 8½d.				0 5 8
			1,280	160	gallons at 1/-					9 13 4
			1,320	at 35/- per 1,000						2 6 2
		17 13 0	at 18/9							16 10 11
									Total for 217 days	£30 10 8

	£ s. d.	
£30 10s. 8d. for 217 days	42 4 3	for 300 days
Allow for tools and sundries	10 0 0	
Maintenance contract	40 0 0	
Insurance and licences	1 18 10	
Depreciation 5 per cent on £535 ...	26 15 0	
Total for 300 days	£120 18 1	

Cost per diem—motor only, 8s. 3½d.

No. 3 Motor.

1914-15.	Dust collected.	Coke.	Bundles of wood.	Cylinder oil.	Paraffin.	Lard oil.	Boiler fluid.	Cotton waste.		
	T. c. q.	T. c. q.		pts.	pts.	pts.	pts.	lb.		£ s. d.
June qr.	372 5 0	5 1 0	444	352	16	4	22	8		
Sept. qr.	312 3 3	4 4 2	408	200	24	5	20	8		
Dec. qr.	465 10 1	5 6 0	444	248	16	5	22	10		
	1,149 19 0							26	at 27/- per cwt.	0 6 3
							64	8 gallons at 2/6		1 0 0
						14	1¾	gallons at 2/5		0 4 3
					52	4	gallons at 8½d.			0 1 7
				7 0	87½	gallons at 1/-				3 5 9
			1,296	at 35/- per 1,000						2 5 1
		14 11 2	at 18/9							13 13 3
									Total for 213 days	£22 19 5

	£ s. d.	
£22 19s. 5d. for 213 days	32 7 0	for 300 days
Allow for tools and sundries	10 0 0	
Maintenance contract	40 0 0	
Insurance and drivers	1 18 10	
Depreciation 5 per cent on £555	26 15 0	
	£111 0 10	

Cost per diem—motor only, 7s. 5d.

In conclusion, the author regrets that pressure of work, owing to the war, has rendered it impossible for him to enter more fully into the subject, but he is convinced that haulage by mechanical means is economical, and that such means will be found reliable and satisfactory to the municipal engineer. He desires, however, to point out that the vehicles for which he gives the costs are all steam vehicles, with iron-tyred wheels, and that, though such wheels have proved themselves satisfactory in ordinary working in prove a serious difficulty in a prolonged winter unless some means are taken to ensure the wheels gripping the frozen snow.

The Civic Engineer's Who's Who, compiled by the editor of The Surveyor and Municipal and County Engineer, for a second annual issue is remarkably complete. The biographical matter is full and methodically arranged. The book is published by the St. Bride's Press, Limited.—*Liverpool Courier.*

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING IN LONDON—(2).

We supplement below our summarised account of the discussion of the annual report of the Institution of Municipal and County Engineers submitted at the annual general meeting which opened on the 24th inst. at the Institution of Civil Engineers, Great George-street, Westminster, by a more extended report, which lack of space prevented us from printing in the last issue of The Surveyor. In addition to those whose names were given in that issue, the attendance at the meeting included Messrs. S. P. Andrews (Faversham), C. O. Baines (Paignton), G. Ball (Bexhill), P. A. Benn (Lichfield), J. P. Bennetts (Harrow), R. Blakeway-Phillips (Wellington), J. H. Blizard (Southampton), E. W. Booth (Wallington), H. Bottomley (Bingley), H. W. Bowen (West Sussex), A. W. Bradley (St. Helens), W. L. Bradley (Tonbridge), J. H. Brierley (Richmond), J. S. Brodie (Blackpool), A. Bromly (Godalming), T. F. Bunting (Maidstone), S. E. Burgess (Middlesbrough), T. A. Busbridge (Maidstone), E. E. W. Butt (Birmingham), L. Caplen (Yeovil), E. R. Capon (Epsom), G. E. Carter (Winchester), W. B. Chancellor (Barnet), H. Clegg (Felixstowe), W. A. Clegg (Dorking), H. M. de Colleville (London), J. Cook (Blackpool), E. C. Cooper (Shanklin), A. P. I. Cotterell (Westminster), W. G. Cross (Richmond), C. H. Croxford (Wood Green), A. E. Darby (Bethnal Green), D. M. Davies (Neath), C. Day (Chatham), H. Dearden (Dewsbury), R. Dixon (Stratford-on-Avon), F. P. Dolamore (Bournemouth), R. H. Dorman (Armagh), R. Drummond (Paisley), A. Dryland (Surrey), L. F. Dunbar (Hemel Hempstead), D. Edwards (Taunton), W. H. Ellacott (Midlothian), W. Ellis (Barnoldswick), W. Fairley (Westminster), E. E. Finch (London), W. Finch (Cumberland), H. C. Fread (Thames Ditton), F. H. French (Harwich), S. G. Gamble (London), C. F. Gettings (Worcestershire), A. Gladwell (Slough), A. T. Gooseman (Wigan), A. L. Grant (High Wycombe), F. T. Grant (Gravesend), W. J. Hadfield (Sheffield), M. Hainsworth (Teddington), C. Hall (Droylsden), C. W. Hall (Felling-on-Tyne), J. C. Haller (Nottingham), C. L. Hamby (Beccles), J. E. Hargreaves (Farnborough), W. L. Harpur (Brecon C.C.), Frank Harris (Tonbridge), J. W. Harrison (Uxbridge), P. Harrison (Uxbridge), G. W. Hawley (Basford), T. W. A. Hayward (Battersea), J. R. Heath (Swansea), T. Henry (Retford), T. W. E. Higgins (Chelsea), G. B. Hartfree (Alton), B. Haylor (Willesden), S. A. Hill-Willis (Tilbury), A. Hobson (Grimsby), W. Holland (Cheshire), F. G. Holmes (Glasgow), J. W. Horton (Derbyshire), M. W. Jameson (Whitechapel), W. H. Jarvis (Erith), D. M. Jenkins (Neath), W. L. Jenkins (West Suffolk), J. H. Jevons (Hertford), Chris. Jones (Hythe), R. R. Jones (Milnrow), W. P. Jones (Glyncorrwg), A. M. Ker (Warrington), J. S. Killick (Hertfordshire), A. G. Kilner (Wetherby), J. Kirkland (Midlothian), Sir James Lemon (Southampton), J. Lobley (Stoke-on-Trent), H. Mair (Hammersmith), E. B. Martin (Salford), E. G. Mawbey (Leicester), J. R. Mead (Ipswich), A. J. Meeson (Brentwood), R. Millar (Greenock), T. H. Negus (Coleshill), H. A. Newman (Finchley), T. Nisbet (Glasgow), J. P. Norrington (Brixton), F. W. J. Palmer (Herne Bay), R. S. W. Perkins (Ely), G. A. Phillips (Cardiff), E. Picker (Beverley), J. S. Pickering (Cheltenham), E. Van Putten (Lewisham), A. Race (Barrow-in-Furness), W. S. Raine (Hungerford), L. Randerson (Meopham), J. L. Redfern (Gillingham), T. J. Rushbrooke (High Wycombe), E. E. Ryder (Bushey), F. Sadler (Acton), N. Scorgie (Hackney), H. H. Scott (Hove), E. J. Silcock (Westminster), C. P. Smith (Greenwich), H. F. Simpson (Wisbech), J. D. Smith (Dalbeattie), T. R. Smith (Kettering), J. H. Smyth (Willesden), H. V. Snook (Haslemere), J. P. Spencer (North Shields), E. F. Spurrel (Holborn), W. J. Steele (Newcastle-on-Tyne), J. Stevenson (East Molesey), J. E. Swindlehurst (Coventry), E. W. Swinstead (St. Pancras), J. Thomson (Dundee), T. E. Tiffin (Dartford), L. D. Thompson (Cornwall), J. W. Tomlinson (Luton), G. B. Toms (Barnes), J. A. Tonge (Rawmarsh), H. Tremelling (Newport), F. Turner (Morley), Chas. Vawser (Ripon), J. P. Wakeford (Wakefield), A. W. Ward (Shrewsbury), J. D. Watson (Birmingham), C. F. Wike (Sheffield), F. Wilkinson (Wimbledon), J. B. Williams (Daventry), F. J. Wood (Lewes), W. S. Woodcock (Rutland), G. E. Wrigley (Banbury), and H. York (East Barnet Valley).

The chair was taken by Mr. J. S. Pickering, M.Inst.C.E., the retiring president.

THE ANNUAL REPORT.

Mr. Pickering moved the adoption of the report.

Mr. E. Willis (Chiswick) seconded. The report, he said, dealt fully with the work of the various committees, but he did not find any mention of the Orphan Fund. He suggested that in future some slight reference, at all events, should be made to the fund. The subscribers, of course, knew all about the work of the Orphan Fund, but these represented only 12 per cent of the members of the institution. When he stated that in seven cases orphans had received material help during the past year, that there would probably be more to help during the present year, and that, owing to the serious fall in securities, there had been a loss of over £200 on the face value of their investments, there would, he hoped, be a recognition of the emphatic necessity for all the members becoming subscribers to the fund. If each member only gave 5s. per annum their income would be more than doubled. It should be known that many members subscribed a guinea and more, and this fact ought to bring an increase of subscriptions. The report of the fund, he added, was an admirable one, there having been an increased income and an increased cumulative fund.

Mr. T. Henry (East Retford) said he would go further than Mr. Willis, and make it compulsory for every member to subscribe not less than 5s. a year to the Orphan Fund. It might be said that this could not be done under the Articles of Association, but they altered these articles very frequently as it was. They altered them to provide for the election of associate-members on the council. He did not know when that was done, as he had not gone into the matter close enough for that; but if it could be done it would be quite open to the council to alter the Articles of Association so as to allow, say, urban and rural surveyors to be represented on the council. At present the bulk of the members of the council were corporation surveyors and engineers; there was no urban surveyor at all. It was, he quite admitted, rather a difficult matter to deal with, but he thought every branch of the profession ought to be represented on the council as well as the associate-members. The reason why urban surveyors did not get elected might be due, of course, to the indifference shown by members in not voting. If this were so it was a pity that the trouble taken in getting out the ballot lists should be incurred. It was very hard upon the funds of the institution and the officials, and not fair to the members that the vote should not be exercised. The question might arise whether they should compel all the members to send in their ballot papers for the election of members of the council. If only they would alter the Articles of Association so that every branch of the profession might be represented on the council he thought there would be satisfaction where there was at present dissatisfaction. He congratulated the council and officials upon the reduction of the printing account. They used to complain about the large amount spent on printing. Whether the reduction was due to the action of the council or the officials, or was the joint action of both, he did not know; but it was at any rate pleasant to see the figure reduced from four to three. He hoped the item would be again reduced materially next year. He considered that the manner in which the papers were produced was quite satisfactory. They were bound together in a form that was most useful, and the necessity for further printing was avoided.

Mr. H. Gilbert Whyatt (Grimsby) said that at the meeting of the Orphan Fund that morning it was suggested that possibly some of the profits from the "Journal" might be allocated to the fund. That was a matter that would doubtless be considered during the year. It was mentioned that only 200 odd members out of 1,700 subscribed to the fund. Possibly that was because the objects of the fund were not brought officially before the members. The members received a circular from Mr. Robinson, and the annual meeting of the fund was very well reported by the professional papers; but he thought something more was wanted to induce a larger number of members

to subscribe. He noticed that there was no report from the North Midland District contained in the annual report. This district was one of the most important districts, because it was a scattered one, in which there was great difficulty in getting to meetings because nearly all transit was across country, and it generally took from five to seven hours to get from one district to the other. They had held several meetings during the year, but there was no mention of them. The local secretary stated he was not asked to send on the report. He did not know where the fault lay. It was, he supposed, possible for the report to be inserted in the annual report as a separate slip, or it might be included as part of the discussion of this meeting. He moved formally that the omission be rectified by the inclusion of the report.

Mr. T. HENRY seconded, and referred to the difficulties of transit in the East Midland District.

Mr. W. H. GRIEVES (Sutton) inquired what action was to be taken with regard to the circular sent out by the chairman of the North-Western District in respect of the ballot for the council, asking members to vote, and giving the names they were to vote for

The PRESIDENT: That has been dealt with.

Mr. GRIEVES inquired if it was not a fact that every member of the institution mentioned in the letter was elected except one, and whether the North-Western District had got their representation as authorised by the institution, or whether the letter did not constitute canvassing in opposition to the by-laws for the election of members to the council. If it did not constitute canvassing he did not know what did. They took the precaution to include other members, and they were all elected except one, and he got on the district representation after that. The representation was therefore dictated by the chairman and secretary of the North-Western District. It was not giving members who might have done service for twenty years, and who never asked anybody to vote for them, the hope of election. From the letter that he understood was received in the district it appeared that the letter had not been specifically dealt with, and he would suggest that a letter should be sent to the district which was at fault, and not to other districts as well. He had nothing to say against associate-members as associate-members, but he considered that to elect them, as was probably the case in some instances, right away after they had joined the institution was not what was expected by the members. He did not think it was a proper course to adopt. He understood there was a difficulty in getting nominations of associates. He certainly felt there was something wrong in connection with the membership of the council. The North-Western District, by the means they had adopted, was very well represented on the council, but he strongly deprecated such a letter as they had sent out to the members of the institution.

Mr. W. M. JONES (Chester) said he thought the letter to which Mr. Willis alluded constituted canvassing under By-law 14 of the institution. In that event he would like to ask whether the election was valid. If the chairman ruled it did not constitute [illegible] he understood the council had written to the secretaries of the various districts calling attention to the undesirability of issuing such letters; but that did not quite answer the question put to the secretary. He wanted to know if the circular constituted canvassing, for, if so, it appeared the members were not really appointed on the council. He supported Mr. Willis in the matter of the Orphan Fund, and offered the suggestion that possibly the reason why the fund was not in such a satisfactory position was the neglect of the members. Members should be reminded of the fund when they were paying their subscriptions. With respect to the question of the associate-members, he agreed that their procedure was the same as that of other institutions; but he thought they might go further, and increase the interest of members in the institution if the membership of the council were apportioned more among urban and rural districts. All the ability was not found in the larger districts. Many of them preferred the seclusion of the quieter districts. He did not see why they should not do for the urban and rural members under the Articles of Association what they had already done for the associate-members.

Mr. R. BROWN (Southall) asked why they should be continually seeking to alter the Articles of Association. Let them go straight on, and make the institution [illegible] As to the letter of the North-Western District, it appeared to him the best thing would be to throw it in the waste-paper basket. They had these things dinned into their ears over and over again. Let them get to business.

Mr. E. J. ELFORD (Southend-on-Sea), referring to the Orphan Fund, said he found great discrepancies in the amounts subscribed by the various districts. In one of the largest districts the total subscriptions were only a guinea, while others went up to £22. He thought that if the matter was brought before the district meetings some good might be done. As to the circular letter to which allusion had been made, as one whose name appeared in it he had to say that it was done entirely without his knowledge. Personally he deprecated anything of the kind. He should hesitate to say the letter constituted canvassing, but, on the other hand, he thought the council were quite justified in doing what they could to put an end to such a practice.

Mr. A. J. PRICE (Lytham) said he happened to be a member of the North-Western District, though he had nothing to do with the circular. The members were well aware that canvassing went on directly and indirectly, and that there had been a good deal of indirect canvassing in former years. What the North-Western District had done came to the same thing as what had always been done, the only difference being that they did the thing openly. The gentleman who sent out the circular did not consider it canvassing, but at the same time he did not suppose such a thing was likely to occur again. After all, the gentlemen named in the circular were elected. That would seem to show they were men who really had the confidence of the members generally, and that they had made a good selection. (Cries of "Oh!") He asked whether it was not possible to so arrange that some part of the subscriptions should be allocated to the different districts. If there was to be proper representation of the North of England, Scotland, Ireland or Wales it meant a heavy tax upon members who represented the district. They could not get to London from the North under £2, and that was a big tax upon the pocket. The Local Government Officers' Association paid back to the various districts a certain percentage of money for the purpose of carrying out the work, paying the fares of members who lived out of London or those of London members who were called to a district meeting. He believed something of the kind could be done by this institution, and if it was not done by next year he would give notice to raise the matter in the form of a resolution.

Mr. PICKERING, in closing the discussion, remarked that the suggestion of Mr. Willis with respect to the Orphan Fund would appear in full in the "Journal." There did not appear to be any reason why there should not be a paragraph in the annual report with reference to the fund, and the secretary would bear it in mind in the ensuing year. He (the President) would press upon members the necessity for more liberal subscriptions to the fund. Of course, they knew that members had to give subscriptions to a good many objects; but this one, at all events, was a very deserving one, and it was to be hoped they would not have to continue to lament the fact that only a small percentage of members subscribed to the fund. With respect to the report of the East Midland District not appearing, he had to say that all the reports which came in were included. As to the circular of which mention had been made, he thought the matter might be allowed to drop. It was evidently contrary to the wishes of the members that such circulars should be distributed, and it was certainly against the wish of the council. Although it might not be contrary to the letter of the by-laws, the circular was certainly contrary to their spirit. As to the validity of the members elected, there was no question about that, because the members elected had no knowledge their names would appear. A general circular had been sent to the districts on the subject, and it had had the desired effect. It would, he thought, be much more acceptable if questions arising out of the council election were sent to the council, who would consider any suggestions that might be made. He might state that the names of six past-presidents had appeared in the report owing to a printer's error, and that it would be duly corrected.

UNVEILING A PORTRAIT OF THE LATE MR. CHARLES JONES.

A portrait of the late Mr. Charles Jones, of Ealing, having been unveiled,

Mr. PICKERING stated that it was his duty to receive, on behalf of the institution, the portrait of a late member whose memory was cherished by every-

... who knew him with feelings of reverence and respect. The name of Mr. Charles Jones had only ... to be mentioned to bring back to vivid recollections a life endowed with everything good and noble. His name found an honourable place on their roll of membership for over forty years, and during that long period he never relaxed his efforts on behalf of the members of the institution for that status to which he considered they were entitled. He was never happier than when he was taking part in some meeting or function in connection with the institution, and he seemed to be surrounded by a halo of pleasure and delight which cast its influence upon those who were privileged to enjoy his company. As one of the founders of the institution they owed his memory a deep debt of gratitude for what he had achieved, and still more for the splendid example he set in a life of kindness, grace and uprightness. His successful professional career was one of which any man might be proud. After serving Ealing professionally over fifty years, on his retirement he was elected to the mayoralty as a mark of appreciation for valuable service rendered to the community. Unhappily, he did not live to enjoy that honour, and he passed away something like two years ago, leaving the world richer by a well-spent life of over four-score years. This portrait, by the kindness of subscribers, was presented to the institution. It was the replica of a painting by Mr. Marks presented to Mr. Jones by the corporation and people of Ealing in 1910, which hung in the Ealing Town Hall. It was a copy by the same artist, and it would find a conspicuous place in the institution offices, where it would be a reminder of one whose memory was held in great respect, and help them to remember the example Mr. Jones set them in his honourable and straightforward life.

AWARD OF PREMIUMS.

It was announced that the certificates and premiums (three guineas) for papers read during the last twelve months had been awarded as follows:—

Mr. W. B. Acton (British East Africa), "Tropical Hill Roads."

Mr. E. H. [illegible], "Bituminous Carpeting Plant."

Mr. W. J. Goodwin (Salisbury), "Some Notes on the Municipal Works of Salisbury."

Mr. A. S. Parsons (Birmingham), "Recent Highway Bridges in Birmingham."

The President said the papers generally were of such a high order of merit that it had been difficult for the committee to decide which were the most eligible for the premiums.

INSTALLATION OF THE NEW PRESIDENT.

The Retiring President next rose and said the time had arrived when he had to relinquish the office which by their indulgence he had been allowed to occupy during the past twelve months, and to perform the interesting ceremony of formally introducing his successor, and installing him in the position to which he had been unanimously elected. The regret which one naturally felt at yielding up an office so honourable and distinguished was tempered by the knowledge that the reins of office were about to be taken up by one far more able to direct the affairs of the institution than he (the speaker) was. In choosing Mr. Wakelam for their president they had selected a gentleman whose eminence in the profession and abilities and qualifications fitted him particularly to discharge the high duties of the office, and he knew that their confidence had not been misplaced. Mr. Wakelam possessed the esteem and confidence of every member of the council, and he felt sure that he might rely upon receiving the co-operation and support of the members in all he undertook on behalf of the institution. Mr. Wakelam, unfortunately, entered upon his duties at a time when the Empire was engaged in an unparalleled struggle for its integrity, its honour, and all that was held dear by a civilised nation. The serious condition of public affairs militated to a certain extent against the enterprise and administrative duties of local authorities, and caused some reduction of their own activities and progress as an institution. But that was all the more reason why the institution should have at its head one whose experience and abilities would carry them through any difficulties which they might have to encounter during the year. Mr. Wakelam had been a member of the institution, he believed, for something like twenty-seven years, and had taken a prominent part in the deliberations of the council. He had connected himself with every effort taken to raise the status of the municipal engineer, and he was, indeed, included among those who had at all times willingly given their knowledge and experience to others with a view to the improvement of the profession generally. It was only fitting that the services he had rendered to the institution and the community should be rewarded by conferring upon him the greatest distinction they were able to offer to him, and he (the speaker) felt sure that the duties of the presidency would be carried out by Mr. Wakelam with honour to himself and with credit to the institution. In investing Mr. Wakelam with the chain and badge of office, Mr. Pickering said the links of which the chain was composed contained the names of forty past-presidents of the institution, each one of whom had done his utmost, with the assistance of the members, to raise the institution to the prosperous position it occupied to-day. He ventured to express the hope that when, at the end of the year, another link was added to the chain, it might be emblematical of the added strength and usefulness of the institution brought about by the devotion of Mr. Wakelam to its welfare. He congratulated that gentleman upon occupying the position of president, and offered him the heartiest wishes of the members for a happy and prosperous year of office.

Mr. Wakelam then, amid hearty applause, assumed the chair vacated by Mr. Pickering.

THANKS TO THE RETIRING PRESIDENT.

Sir J. Lemon (Southampton, past-president and hon. treasurer), after congratulating the new president upon his election, said that before that gentleman delivered his address he might be allowed to intervene with a proposition that did not appear on the agenda. They wished to honour the old love before they were on with the new, and he therefore proposed a vote of thanks to the retiring president for his services during the year. Mr. Pickering had given constant attention to his duties, and he had exhibited an invariable courtesy that endeared him to all of them. Their only regret was that they could not bestow upon him some enduring mark of their favour. In the absence of this the very least they could do was to accord him a hearty vote of thanks for his services.

Mr. E. G. Mawbey (Leicester, past-president) seconded the proposition.

Mr. Pickering, in response, expressed his thanks for that appreciation of the vote. He need hardly say that any service he had been able to render to the institution during his year of office had been freely and ungrudgingly given. In looking back upon the past year he felt that the work he had done was but a poor return for the honour they had conferred upon him. He felt that much that might have been done had been left unaccomplished. Happily, anything that had been lacking on his part had been more than made up by the energy and devotion of the members of the council generally. It had been a year of continued progress. The institution had never been in a more flourishing condition than it was that day. It was sound financially, and it had made satisfactory and substantial progress numerically. Its "Proceedings" contained contributions of the highest professional and literary merit, and the report contained evidence of the advancement of the institution. One of the most interesting features was the number of meetings held as compared with previous years. There had been twenty-one meetings, and between fifty and sixty papers had been prepared for discussion, apart from the contributions published in the "Journal." Considering the condition of national affairs this was a highly satisfactory record. The increase was undoubtedly due to the formation of the district committees, among whom there had been a friendly rivalry which had had the effect of stimulating individual effort. He thanked the council, officials, and members generally for the kind support and consideration given to him during his year of office, and he only trusted that any shortcomings on his part would be generously overlooked by them all.

Mr. Wakelam then proceeded to deliver his presidential address, a full report of which appeared last week. The vote of thanks to the new president for his address was moved by Mr. E. G. Mawbey, and seconded by Mr. E. Willis.

(To be continued.)

THE ANNUAL DINNER.

There was a large attendance on Friday evening at the annual dinner of the institution, which was held at the Hotel Cecil. The president, Mr. H. T. Wakelam, M.Inst.C.E., occupied the chair, and the

guests included Sir George Gibb, chairman of the Road Board, Sir Laurence Gomme, Colonel Holland, R.E., the Right Hon. H. Hobhouse, chairman, County Councils Association, Mr. W. Regester, chairman of the Middlesex County Council, Mr. C. Pinkham, chairman of the Middlesex Highways Committee, Mr. Balfour Browne, K.C., Mr. F. Goodyear, vice-chairman of the Middlesex Highways Committee, Mr. W. Rees Jeffreys, secretary of the Road Board, Mr. B. Hall Blyth, president of the Institution of Civil Engineers, Mr. Honoratius Lloyd, K.C., Mr. A. W. Perkin, vice-chairman of the Middlesex Rivers Committee, Mr. G. W. Barber, chairman of the Middlesex General Purposes Committee, Mr. J. M. Norman, chairman of the Middlesex Asylums Committee, Mr. Raymond Unwin, town planning department, Local Government Board, Mr. H. Heldmann, chairman of the Middlesex Finance Committee, Mr. W. Godson, vice-chairman of the Middlesex Buildings Committee, and Mr. Isaac Shone.

The toast of "The Public Authorities" was proposed by Mr. O. CLAUDE ROBSON in a speech appreciative of the vast amount of valuable work that was carried out by the members of those bodies—work that, he was afraid, was not recognised by the general body of the public as it should be.

The Right Hon. H. HOBHOUSE and Alderman C. PINKHAM responded.

Mr. W. REGESTER, in proposing "The Institution," said he could not help thinking that the Institution of Municipal and County Engineers was a body to which public authorities must look for help. The primary duty of engineers to public bodies was to advise the latter how wisely to spend, but he thought their duty in the coming year would be to advise them how wisely to save, and even if certain schemes had to be set aside he was sure they would feel themselves bound to assist in this way in order that the silver bullets might be moulded to win for the country a victory over the water. His experience of public life went back to a time prior to the formation of that institution. Mr. Wakelam went to Middlesex nearly twenty years ago, and the county was fortunate in getting him. He had made the best of his opportunity. He had helped them to spend something between £2,000,000 and £3,000,000, and the money had, he thought, been spent most wisely. He was a man of imagination. His works had included a series of important tramways and light railways, and he had constructed for them eight very excellent court-houses. He had also done a great deal with small holdings, and he was now proceeding, in conjunction with the Road Board, to lay out what it was hoped would be an ideal road, and an example to other authorities throughout the country—the Great West Road. This was a thoroughfare that was never going to be disturbed by gas or water companies, and engineers would appreciate what that meant. What Mr. Wakelam was doing, with the full consent of his council, was to try an experiment, and, personally, he thought that men who were willing and anxious to put their brains into an experiment ought to be encouraged to do it. The ideal road had still to be discovered, but he thought the road he had spoken of represented a step in that direction.

The PRESIDENT, who was heartily received on rising to reply, said it was seventeen years since he went to Middlesex. He wished to acknowledge the kindly remarks that Mr. Regester had made in proposing the toast. When members of public authorities appreciated the labours of their officials it was very gratifying to the latter. Appreciation to him—as to other public officials—always meant encouragement and increased energies and endeavours. Turning to the institution, Mr. Wakelam remarked that between 150 and 160 of their members were on active service at the present time. They missed their faces on that occasion, and he was sure the company would join with him in wishing them a speedy and safe return to their duties. Many were absent that night because of the war, but, much as they deplored the war, he did not think any good would be served by meeting trouble half way. What they had to do was not to sit down, but to make every endeavour to try and frustrate the enemy they had to deal with. The fact that their numbers had increased in the past five years by over 500 spoke exceptionally well, he thought, for the popularity and usefulness of the institution. They had members not only in England, Ireland, Scotland and Wales, but in India, Canada, South Africa, Ceylon, New Zealand, New South Wales, and other countries and colonies. He personally had known the work of the institution for nearly forty years. He had been connected with it for nearly twenty-seven years, and it had afforded him great pleasure to see the increasing value to the country at large of the labours of the institution and the way in which the members had performed their duties. The institution was founded in 1873—two years before the passing of the Public Health Act. Since that time the members of the institution had been responsible for the spending of a great deal more than £100,000,000 sterling in providing water supply and sewerage schemes for England and Wales alone. He thought that spoke volumes for the manner in which they had ministered to the welfare of the community. The results were to be found in the improvement which had taken place in the health statistics. Concluding, Mr. Wakelam said he was grateful to the members for having elected him as their president, and he hoped that at the end of his term they would be able to say: "If Wakelam didn't possess all the qualities of an ideal president, he certainly did his best in the interests of the institution."

The toast of "Kindred Institutions" was proposed by Mr. A. E. COLLINS, and acknowledged by Mr. B. HALL BLYTH.

Sir JAMES LEMON proposed "The Visitors."

Sir GEORGE GIBB, chairman of the Road Board, in responding to the toast, said he was a great believer in and admirer of the system of local government of this country, and as one who had seen a good deal of them he confessed he was always greatly impressed with the officials of public authorities. Proceeding, Sir George said a natural question at the present time would be as to how the war had affected the distribution of grants under the administration of the body with which he was specially connected. Whatever might be said about expenditure it was a gratifying fact that the income of the board had not been affected. It was quite remarkable to find that, on comparing the first six months of 1915 with the corresponding period of last year, the actual money received was £30,000 up. Another point that might interest them was that the Road Board had recently been doing some special work in connection with the improvement of roads for military purposes. Without doubt the special traffic due to the war had affected a good many of the roads, and questions had arisen, and would continue to arise, as to the effect of this extraordinary traffic. An arrangement was made by the War Office that the Road Board should act as a sort of intermediary between the local authorities and the War Office to deal with the question, and carry out a good many improvements that were required in order to strengthen roads that might be used for military purposes, and already they had spent on work—which, of course, was of benefit to the local authorities of the areas concerned—nearly £500,000, the board in some cases contributing to the expenditure; but they had been very careful not to allow the Road Board funds to be diverted to any work which could not be justified as a work of permanent public improvement for the purposes of ordinary traffic. That work had been arranged and carried out by the engineer to the board, Mr. Maybury, to whom he would like to express his indebtedness for all he had done. Mr. Maybury was a member of their institution, and he could not speak too highly of his knowledge and experience and helpfulness in dealing with highway authorities in all these matters of road improvement. Perhaps it would interest them if he said something about the distribution of grants. In view of the stupendous financial burden of the war, it was very natural and proper that the Treasury should direct, as they did, that the scale of the Road Board's grants should, for the time being, be lessened. He thought, however, that the grants available for work during the ensuing year would, although reduced in amount, probably be adequate for the purpose, because he had no doubt that every local authority would prefer to spend as little money as possible during the war period. He thought that most of those present would approve of that, and that if there was less money to be spent it was far better to reduce the quantity of the work to be done rather than lower the quality. That was a point he was always glad to have an opportunity of impressing on the experts who had control of these things, because he thought it would be a great pity if, in the desire to economise, there was any depreciation of the existing high standard of work that was going on all over the country. He supposed that everyone connected with local government had felt disappointment that the advent of the war had interfered with the completion of the scheme which was embodied in the Government Bill of last

year for additional maintenance grants for roads. That the need for these grants had been established was admitted, and it would be a very great disappointment, he thought, and would also be most unfortunate, if the rearrangement of these grants were to be entirely abandoned. It might be difficult to find money for objects of that sort, but he hoped that the subject would not be altogether shelved, but that the Government would see its way later on to proceed with at least a part of the scheme.

Mr. Honoratius Lloyd, K.C., also replied to the toast.

VISITS.

The discussion of papers was brought to a close on Friday, and Saturday was given over to a visit to the Kingston sewage disposal works, and to inspections of the works in connection with the reconstruction of Southwark Bridge and a new underground tube from the General Post Office to Paddington. Well over 200 members chose to go to Kingston, and the majority elected to make the journey by water, a commodious steam launch having been chartered for the occasion.

Leaving Westminster Bridge shortly after 9 o'clock, the party were first taken on to Tagg's Island—an enjoyable four hours' trip—where they were the guests of the president at luncheon, with the Mayor of Kingston, Alderman C. H. Burge, F.I.C., as the guest of honour. Returning downstream the members landed at Kingston at 3.30, and proceeded at once to the sewage disposal works, full particulars with regard to which were furnished by Mr. R. Hampton Clucas, the borough surveyor, in one of the papers presented at the meeting. Following the inspection, the members passed into Canbury Gardens, a delightful open space on the banks of the river, which was also briefly described in Mr. Clucas' paper. Here, after an examination of the beautifully kept bowling greens and tennis courts, the visitors were entertained to tea by the Mayor and Mayoress, hospitality which was acknowledged in cordial terms by the president before the company separated. The institution, said Mr. Wakelam, in the course of his remarks, was always welcome in whatever town it visited, but they had been received that day in a manner which had never been, to his knowledge, excelled, or even equalled. Referring to a tribute which the mayor had paid to the services that Mr. Clucas had rendered in his capacity as borough surveyor of Kingston, the president added that some of them had had the pleasure of knowing Mr. Clucas for many years as an able engineer, and it was to be hoped that his excellent labours would be suitably rewarded.

SOUTHWARK BRIDGE RECONSTRUCTION.

This work, which was seen in the morning by a fair number of members, comprises the removal of the old Southwark Bridge and the erection on the same site of a new bridge with improved gradients.

The old Southwark Bridge consisted of three cast-iron arches, the largest span being 240 ft. The bridge was designed by Rennie, and was opened to public traffic in 1819. The Corporation of London decided upon its removal on account of the steepness of its gradients—1 in 18 on the City side—and because its piers were out of alignment with the other bridges in the vicinity. The new bridge consists of five steel arches, and the worst gradient is about 1 in 33.

At the present stage the old bridge has been entirely removed, and the foundations for the new piers are in hand. Each of the new piers will be of stone, and will be founded on caissons sunk into the bed of the river. The caissons will be sunk under compressed air, and as they sink the piers will be built on top of them. Each of the arches will be constructed with seven ribs, and upon these the steel flooring supporting the roadway and footpaths will be laid. The width between parapets will be 55 ft., the roadway being 35 ft. in width and the footpath 10 ft. The old bridge was 42 ft. 6 in. wide.

Waterproofing of Buildings.—Damp walls are about the most frequent trouble that architects and those engaged in the building trade experience. It is therefore interesting to know that the Accrington drill hall has been recently waterproofed with Pudlo-ed cement renderings, the result being completely successful.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Have we not all been struck with the dignity, urbanity and business-like manner with which the newly-elected president of the Institution of Municipal and County Engineers conducted the meetings of last week? Shall we not all feel that in his hands the institution will make still further progress towards the public and official recognition which it has so long deserved?

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Were not the gatherings of the institution in the large lecture hall of the Institution of Civil Engineers very remarkable, not only on account of the numbers which assembled, but also because of the intelligence and knowledge displayed by the numerous speakers? Is it not to be regretted that there were not several members of Parliament present to hear some of the debates, and thus become somewhat acquainted with the work and value of the municipal engineer?

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Were not some of us who attended the overcrowded and fearfully stuffy National Road Conference on Monday last to hear the papers on "Resurfacing of Main Roads in Essex" and the "Adequacy of Bituminous Roads in Herefordshire" somewhat disappointed with the discussion? Was it not to be regretted that so few of the speakers discussed the papers at all, but aired their own views and gave us lectures on elementary facts with regard to road making? Were not the two excellent papers worthy of a better and more interesting discussion?

* * * *

Can we arrive at any definite conclusions after hearing the papers and discussions at the recent meeting of the Institution of Municipal and County Engineers and the Road Congress? Have we not, some of us, come away with the feeling that foundations are of the utmost importance, the sealing of the surface is essential, the composition of the bituminous "filler" must be closely investigated, each case must be dealt with "on its merits" according to local conditions, and that above all money is a *sine quâ non* if we are to have good roads?

* * * *

Were not most of the exhibits at the National Road Exhibition of great interest and use? Why, however, were there many exhibits of goods, excellent in their way, no doubt, but having nothing whatever to do with road work?

* * * *

Is it not rather interesting to note that at the commencement of the war local authorities were urged to proceed with public works in order to prevent the distress which was then feared, and that now there is a complete change of policy, and nearly all public works have been stopped, so that all labour, money, and energy of all descriptions may be concentrated on our sole objective—viz., the defeat of our enemies?

* * * *

Is it a fact that certain roads which were recently constructed on the most modern lines in a large urban district near London have proved to be failures? If this is so, would it not be of the greatest interest to all road engineers if the details of construction and the reasons for the failure could be published? Do we not all learn quite as much, or even more, by failures than from successes, and would it not advance our knowledge on all engineering subjects if engineers were always bold and unselfish enough to tell us of their failures and the reasons for such failures?

Exeter Corporation Tramways.—In submitting the report of the Tramways Committee at the last meeting of Exeter City Council, Alderman Varwell stated that during the year ended March 31st the tramway receipts were £17,964—the highest they had ever received, and an increase of £474 over the previous year. The accounts showed a surplus of £2,100, which would be carried to the reserve and renewals fund account. That was an increase of £385 on the previous year, but that increase was more than accounted for by the reduction in the cost of the electric current supplied and an allowance in respect of the previous year. Renewals had cost £2,228—the largest amount ever spent under this heading. Besides paying their way, the tramways had set aside £20,000 for the redemption of capital expenditure.

Mechanical Traction for Municipal Work.*

By ERNEST J. ELFORD, M.INST.C.E., M.I.MECH.E., Borough Engineer and Surveyor, Southend-on-Sea.

The subject of mechanical traction is one in which municipal engineers cannot fail to take a deep interest from two distinctly opposite points of view. Those who have adopted mechanically-propelled vehicles in connection with the work of their departments generally have reason to bless them, but it is to be feared that these same engineers have often cursed, with energy and sincerity, similar vehicles used by other folk, to the serious prejudice of the roads, for the maintenance of which they are responsible.

The following short notes, which in a weak moment the author promised the president to prepare for this meeting, deal with the subject entirely from the former point of view.

It is well known that the work of a municipal engineer is of great variety, in fact, his duties is often described as the "handy man" in "local government," and it is now generally recognised that when there is anything to be done which other departments are unwilling or unable to undertake a simple solution may be found in the well-known formula, "the engineer was instructed."

It is important, therefore, that he should endeavour to keep in close touch with improvements in methods, materials and appliances which are likely to be of advantage in connection with work for which he is, or may be, responsible.

Among the more important of such improved appliances, mechanically-propelled vehicles for use on highways occupy one of the foremost positions.

They are now used for a number of purposes, including haulage of road and building materials and general haulage, road watering, road sweeping, road tarring, and the collection of road sweepings and house refuse.

The vehicles themselves are also of great variety, some being driven by steam, others by petrol or petroleum, and others more recently by electricity. Some are complete carrying units, while others are capable of hauling only other vehicles carrying the load.

Each type has points of advantage and disadvantage as compared with the others, according to the conditions under which it is required to work.

It should be borne in mind, however, that it is not under all conditions that mechanical traction can successfully compete with horses, and it is important that care and common sense should be exercised in adopting the working conditions to the peculiar requirements of mechanical vehicles when these are adopted.

From the financial point of view, perhaps the most important factor is rapid loading and discharging. Some appreciable delay at each end of a journey with horse-drawn vehicles is unavoidable, and, in fact, desirable, but loss of time with motors makes all the difference between profit and loss. It is essential, therefore, that careful thought should be given to the provision of the best available facilities for loading and unloading, so that as large a proportion as possible of the working hours of the motor should be spent in travelling on the road. It must always be borne in mind that a motor unit is much more expensive in first cost and running cost than a horse unit, and that it can only be made to pay by carrying much larger loads at a much quicker rate. As bearing on this aspect of the question, it is of importance that motor vehicles should be so designed and constructed as to require the minimum of repairs, as repairs mean delay, and delay means serious loss of revenue.

In the author's opinion it seldom pays to buy second-hand motor vehicles, as it is during the first few years of their life, when they can be constantly kept at work, that they are most profitable. As time goes on repairs, with their attendant delays, become increasingly frequent, and for this reason, if a careful account were kept, it would be found that it would pay to sell the old vehicle and purchase a new one long before the former ceased to be capable of doing useful work.

One of the most profitable cartage jobs the author has carried out was the haulage of a large quantity of granite macadam from a wharf at a point about 3½ miles distant from the point at which it was required. The granite was unloaded from the barges by an electric crane. Before the work was commenced a dozen spare skips were provided on the wharf. These were filled and deposited on the wharf by the crane, and when a motor arrived it was loaded within a few minutes from the full skips. The motors were fitted with tipping bodies for quick discharge, and were able to spend a large proportion of their time in travelling.

Where motors are used it is desirable to employ as many as can be kept constantly at work, as under these conditions five, six or more can be used to greater advantage and more profitably than one or two.

For instance, large loading and unloading gangs can be employed, and this means shorter terminal delays. The cost and delay of repairs can also be much reduced when there is sufficient motor or other work to justify the provision of a workshop and staff, so that repairs can be done promptly at the depot. In addition, where a number of steam vehicles are employed, the boiler cleaning and overhauling can be done at night by a separate gang, who can also light the fires and get up steam ready for the drivers in the morning, so that there may be no unnecessary curtailment of the working hours of the vehicles. It goes almost without saying that the work must be carefully organised and supervised, as an hour wasted by a vehicle of this kind entails a loss equal to four or five hours with a horse and cart.

STEAM-DRIVEN VEHICLES.

For some time vehicles of this description were used almost entirely by local authorities, and even now they appear to be still holding their own very well. Under some conditions and for some kinds of work they are no doubt more satisfactory than petrol vehicles. Their chief advantages lie in their comparative simplicity, substantial construction, flexibility, and large reserve of power.

Any man of ordinary intelligence who has been used to driving a steam roller or other steam engine can soon become capable of driving a steam vehicle, and, as a rule, the results of any inexperience or carelessness on his part are not so serious as would be the case with a petrol vehicle. If well designed, built, and cared for, a steam vehicle will last many years. The reserve of power of a steam engine is often of great value when the vehicle is operating over bad roads, or when it is necessary to temporarily overload.

Another advantage is that, except in the event of serious damage, a steam vehicle is seldom entirely incapacitated, so that it can generally be driven home.

In addition, a steam vehicle can be more easily and satisfactorily adapted for use as a stationary engine for driving such plant as concrete or tar-macadam mixers, mortar mills, pumps, &c. Another factor in favour of steam vehicles is their low running cost.

On the other hand, vehicles of this kind have several disadvantages. The boiler, coal supply, &c., add considerably to the weight; they are not available at short notice, as steam cannot be raised in less than forty-five minutes; washing out and overhaul of the boiler usually takes about six hours each week, and where the water is not suitable the boiler is likely to give trouble by leaking tubes, priming, &c. This is particularly the case with some of the more delicate water-tube boilers.

PETROL VEHICLES.

During recent years this type of vehicle has been growing in popularity, but more, perhaps, for light trade purposes than for municipal work. The principal factors which are responsible for this growth in favour are speed and convenience, which, for many classes of work, outweigh the advantages connected with the use of the steam vehicle. For instance, it will be readily understood that the higher running costs and depreciation of a petrol motor fire engine are of little importance compared with its higher speed and the great saving in time resulting from being able to start off at a moment's notice, and to operate the pumps without waiting for or maintaining steam.

On the other hand, a petrol motor vehicle can easily

* Paper presented at the annual meeting of the Institution of Municipal and County Engineers in London last week.

be damaged and the running costs increased by unskilful or careless driving. In addition, it often happens that some slight defect will place the motor *hors de combat* for the time being, especially when driven by a man who does not thoroughly understand the mechanism.

At one time petrol motors were designed with a fair margin of power, but now, as a rule, the excess, if any, is very small, and it can be safely assumed that a motor specified to be, say, 30-b.h.p., will, on test, be found to develop as nearly as possible that power, and cannot be pressed, even for a short period, much beyond its rated capacity. As before stated, this is not the case with the engine of a steam vehicle, and the latter is able therefore to extricate itself with greater ease when in difficulties, and to adapt itself more easily to the varying conditions. For this reason also a petrol vehicle is not suitable for drawing a trailer unless specially constructed for that purpose.

The author has used both steam and petrol vans for street watering, and is of opinion that steam vans are the better for this purpose where they are convertible for general haulage purposes, but that petrol motors are better where they are used only for street watering.

The latter are always available for instant use, cover a great length of road in a given time, and are quieter.

The reduced noise is specially appreciated in residential districts, particularly when the water vans are out in the early mornings and on Sundays.

The majority of motor vehicles used for municipal work are convertible, so that they may be available for more than one class of work. In many cases they are used during the summer months for street watering, and during the remainder of the year for general cartage. For the former purpose it is the author's practice to use cylindrical tanks for quantities up to 600 gallons and rectangular tanks for larger quantities. The smaller tanks are provided with petrol motors, which are used almost entirely for street watering and sewer flushing. The larger tanks generally have a capacity of about 1,000 gallons, and are used with 5-ton steam motors during the summer only. When interchangeable bodies are required, the chassis and bodies should be so designed that the latter may be changed quickly and with the minimum of trouble. With this object the water tank should be provided with spreaders, which stand clear of the chassis, and the operating gear should be entirely attached to the tank. This gear should be controlled by foot, so that both driving and watering can be managed by one man. To meet these conditions spreaders of the box-type are probably the most convenient and effective.

Suitable lifting gear should be provided at the depot where the bodies are changed.

The author is a firm believer in rubber tyres, except for vehicles which use bad roads, where the wear and tear of this material is likely to be abnormal. Not only does the rubber reduce the noise, but it also largely reduces the wear and tear of the whole vehicle, particularly on stone setts and other roads where the surface is not perfectly smooth. In addition greater speed can be attained with rubber tyres. The author has found that speedometers of good make are quite satisfactory with rubber tyres, but he has been unable to obtain one which gives good results with steel tyres, owing to the excessive vibration.

He is also of opinion that it pays to rather over-tyre than under-tyre, and it is his practice to specify for the wheels of a 5-ton steam vehicle the largest rubber tyres made. The rubber tyres of some of the vehicles under the author's control are maintained under contract at a charge of 1¾d. per car-mile per set of six tyres (twin tyres on driving wheels). He has found the cost of this arrangement to compare satisfactorily with the purchase of tyres outright, and one advantage of the former system is that the tyre cost is directly proportionate to the work done, so that there is less fluctuation in the annual accounts. It is sometimes of advantage to provide interchangeable wheels, one set with rubber and the other with steel tyres, the former for use in the summer on good roads, and the latter for use in the winter.

For general cartage work it is essential to provide a tipping body, preferably operated by engine power, but care must be exercised in selecting the tipping gear, as some designs are much more satisfactory than others.

The above remarks in reference to chain drive and wheels are also applicable to petrol vehicles. The only other points to which it is necessary to call attention are the desirability of providing the motor with gate change gear, and pump circulator and fan. The author has not had experience of any petroleum carburetter suitable for petrol vans, but has found this fuel quite satisfactory for motor rollers, which are comparatively slow moving. In connection with the latter it is necessary to clear the cylinders and pistons of carbon accumulations from time to time to ensure satisfactory running.

Before referring briefly to the recently-introduced electric vehicles for municipal work, it may be of interest to mention some points of some importance relating to the design and construction of steam and petrol vehicles.

Dealing with the former first, a feature which, in the author's opinion, is of great importance is the position of the engine. This point does not arise in connection with petrol motors, as the engine is generally so placed as to be easily accessible.

Until comparatively recently, however, steam vehicles were built with their engines under the body, where they could not be reached without great trouble, and, in many cases, the dismantling of the vehicle. The author experienced so much difficulty with under-type engines in the early days of municipal motor vehicles that he decided to advise his council not to make further purchases of this class of vehicle, but to insist upon the engine being so mounted as to be in full view of the driver, and with every part easily accessible without dismantling any part of the body or chassis. Apparently this has been the general experience, as the majority of makers are now building vehicles of this character. The author is convinced that the most satisfactory design is that which provides a horizontal fire-tube, loco-type boiler, with engine mounted on same, after the style of a steam roller or traction engine. This type of boiler has several advantages compared with the other kinds used for this class of work, either water-tube or vertical boilers. It has greater steam and water capacity inspection, cleaning and repairs more easily carried out, tubes can be expanded, removed and replaced with less trouble, and are less liable to leakage, the boiler forms a suitable and substantial setting for the engine, and, as a rule, the fire-box is more conveniently arranged. On the other hand, as usually constructed this class of boiler is more liable than the vertical type to have the safety plug uncovered when descending a hill, but this risk can be obviated by attention to the point by the designer, and the exercise of reasonable care on the part of the driver. A horizontal boiler occupies somewhat more space and involves a greater length of chassis, but this is comparatively unimportant.

It is of advantage to superheat when the vehicle is in the hands of a good man, but, unless it receives careful attention, a superheater is liable to be a source of trouble.

The engine should be compound, with by-pass, for turning live steam into low-pressure cylinder, as this gives largely increased power, which is very useful on a stiff gradient or when in a "tight place."

Forced lubrication should be specified for the engines of steam-driven vehicles.

Chain drive is now almost universally adopted for vehicles of this kind, and the only point regarding this feature to which the author desires to draw attention is the desirability of properly protecting the chain from dust and dirt, which, without such protection, is bound to reduce its life and interfere with smooth running.

The author has usually used wood wheels, but these have several disadvantages as compared with steel wheels. In dry weather the wood is found to shrink, and in provincial towns, where there is no hydraulic apparatus handy for repressing, the expense and delay involved by having to send the wheels to the nearest press for this purpose is a serious item. On the other hand, wood wheels appear to be more resilient and less noisy than steel. It is an advantage to provide locking gear for the differential, so that the drive can be by both wheels when it is necessary to get the vehicle out of a bad place.

The author has lately been considering the question of electric vehicles, principally for the collection and cartage of house refuse, and he has formed the opinion that they are likely to be of advantage for this and other municipal work.

The Southend Corporation has for some months been running an electric 'bus in service with petrol 'buses, and the electrical engineer has reported very favourably upon the former, which is a single-deck vehicle, seating twenty-two passengers, and weighing when empty 4 tons 1 cwt.

On a test of fourteen double journeys, in ordinary

service with the petrol 'buses, the electric vehicle covered 89 miles at an average speed of nearly 9 miles per hour, including stops. The route was undulating, with sharp gradients in places, the 'bus was well loaded on all journeys, and the current consumption was at the rate of 1·56 units per mile.

From experience up to date it appears that an electric 'bus will cost from 10 per cent to 15 per cent less per 'bus mile than a petrol 'bus, including capital and other charges, and as the corporation are the owners of the electric supply undertaking, a profit is made out of the current consumed by the former.

One great advantage of the electric drive is that a skilled driver is not required; in fact, any man of ordinary intelligence can be engaged for this work. The moving parts are few in number, and the mechanism generally of a simple character. Another advantage of some importance is the reduced risk of fire.

For the collection of house refuse the Edison Accumulator Company suggest 3-ton electric vans, having a capacity of 8 cub. yds., and 2-ton vans having a capacity of 8 cub. yds. The speed of the 3-ton vehicle fully loaded is given as 8 to 9 miles, and of the 2-ton as 10 miles. The weighing and tipping at the destructor is estimated to occupy five or six minutes. The larger vehicles are proposed for the longer, and the smaller for the shorter distances.

Each size vehicle is estimated to collect and deliver to the destructor from 9 tons to 9½ tons of refuse per day.

The company have submitted the following estimates in reference to the annual cost of the vans above referred to, and suggest that a very large saving in the total cost of house refuse collection and carriage could be effected by the adoption of their proposals. In many towns steam for the generation of electric current is available at the refuse destructor, so that the charging of accumulators for electric vehicles could be done at very little cost.

Estimated cost of maintaining and running a 2-ton Edison accumulator van, including painting, &c., complete with patent electric tipper and galvanised steel plate, hot riveted body, costing per vehicle approximately £990:—

	£	s.	d.
Write off 10 per cent.	99	0	0
Average interest, approximate ...	25	0	0
Assume 20 miles per day = 1d. charge of 48 units per day = 2s. × 300 days	30	0	0
Maintenance per mile, ·65d.	16	5	0
Insurance	10	0	0
Repainting van	5	0	0
Rent of garage ...	5	0	0
Tyres, half set per annum, at £40	20	0	0
	210	5	0
Labour	78	0	0
	£288	5	0

Estimated cost of maintaining and running a 3-ton Edison accumulator van, including painting, &c., complete with patent electric tipper and galvanised steel plate, hot riveted body, costing per vehicle approximately £1,075:—

	£	s.	d.
Write off 10 years	107	10	0
Average interest, approximate	27	0	0
Assume 30 miles per day current at 1d. = ⅔ charge of 48 units per day = 2s. 8d. × 300 days	40	0	0
Maintenance per mile, ·75d. ...	28	2	6
Insurance	10	0	0
Repainting	5	0	0
Rent of garage per vehicle	5	0	0
Tyres, ⅓ set per annum, at £55 ...	41	5	0
	263	17	6
Wages	78	0	0
	£344	17	6

Another kind of vehicle which has been brought to the author's notice is of a platform type, to which any kind of body or tank can be fitted, and, if necessary, a small hand crane is available either to tip the body or to lift weights up to 12 cwt. The carrying capacity of this vehicle is up to 2 tons. It has a worm drive, and is easily manœuvred in traffic. The vehicle is peculiar in not having the usual accommodation for a driver, which in many forms of municipal work proves a disadvantage, as the driver deems it his privilege to remain stedfast in this position, and refrains from assisting in the loading. The vehicle has at one end a small platform about 14 in. from the ground, upon which the driver stands, and from which he can easily control it. The action of dismounting automatically locks the wheels and cuts the current circuit, thus preventing danger from the interference of meddlesome people should the vehicle be left unattended. It appears specially suited for handling the contents of orderly bins, road sweepings, gully deposits, and road materials. The author is informed that a considerable number of these are in use on various railways and docks throughout the country.

The estimated annual charge for this vehicle, including capital and interest, maintenance, current, and lubrication, but not including labour, is £100, assuming a total mileage of 6,000 miles per annum.

The vital part of all electric vehicles is, of course, the accumulator, and, although efforts have been made from time to time during the past years to place upon the market vehicles of this type for haulage purposes, it is only comparatively recently that, as the result of the introduction of the new Edison nickel-iron battery, they have been successful in giving results of a permanently satisfactory character.

Unfortunately, the vehicles are expensive in first cost, and this is likely to be an obstacle to their general adoption, at any rate until their alleged good qualities are proved beyond all question.

Statements of running costs and comparisons between the cost of haulage by motor vehicles of various kinds and by horses are likely to be very misleading, unless due weight is given to local conditions. To form a reliable opinion upon figures of this kind it is necessary to take into consideration all the factors upon which such figures have been based, including cost of labour, coal, petrol, and horse hire, and the nature of the work done and the conditions under which it is carried out.

The human factor is also of some importance, as one man will use 50 per cent more coal, oil, &c., than another in doing the same amount of work, and the wear and tear, as well as the work done, will vary according to the relative capacities of the men employed.

The following statements relate to a district without many heavy gradients, but somewhat undulating in character:—

Sea water is used for street watering, and in many cases the standpipes are a considerable distance apart, and the pressure not all that could be desired, so that filling takes a longer time than usual.

The author hopes to effect an improvement in the latter respect by providing standpipes and connections of larger bore. The amount of work given is that done by drivers of average quality, and under average working conditions:—

AVERAGE DAY'S COST OF STREET WATERING, GULLY AND STREET FLUSHING, ETC.

STEAM VEHICLES (provided with convertible bodies):—

	s.	d.
Capital charges (loan repayment and interest)	5	2
Depreciation (additional to above)	1	0
Wages (driver 6s. 6d., mate 5s.) ...	11	6
Insurance, rent, &c.	1	8
Oil, waste, &c.	1	0
Coal (3 cwt., at 1s. 4d.)	4	0
Repairs, &c.	2	0
Tyres (rubber, at 1¾d. per car mile)	3	9
Total cost per working day ...	£1	9	1

Cost of vehicle £550 without tyres.
Weight unloaded = 4 tons 19 cwt.
Load 1,000 gallons of water = 4½ tons.
Average day's work 12 loads = 12,000 gallons.
Average day's mileage = 26.
Working days 275 per annum.

PETROL VEHICLES (adapted for street watering and sewer flushing only):—

	s.	d.
Capital charges (loan repayment and interest)	8	0
Depreciation (additional to above)	1	0
Wages (driver 6s. 6d., mate 4s.)...	10	6
Insurance, rent, &c.	1	6
Oil, waste, &c.	0	9
Petrol (6 miles to a gallon, at 1s. 7d.)	9	6
Repairs, &c.	1	6
Tyres (rubber, at 1¾d. per car mile)	5	4
Total cost per working day	£1	18	1

Cost of vehicle £525 without tyres.
Weight unladen = 3 tons.
Load 630 gallons of water = 3 tons.
Average day's work 14 loads = 84,000.
Average day's mileage = 38.
Working days 170.

For heavy haulage the consumption of coal by the steam wagons averages ¼ cwt. to 1½ cwt. for an ordinary day's work, and the cost (including all charges) when the wagons are running in steel tyres is from 27s. to 29s.

Under favourable conditions the steam wagons have hauled five loads of 5 tons each over a distance of 3½ miles at a cost per ton of about 1s. 2d., or per ton mile of under 4d.

The author has recently purchased a second-hand 60-h.p. petrol motor, and is experimenting with it as a tractor for hauling house refuse to the refuse

destructor from those portions of the district furthermost away from same. The refuse is collected by horse vans, and when full the horse is changed over to an empty van brought by the tractor, and the latter takes the full load to the destructor, returning it empty and changing it for another full one. It is too early yet to form a definite opinion as to the results of the experiment, but they appear likely to be satisfactory.

The author regrets that the above notes have been put together very hurriedly, but trusts that they may be found to contain some item for discussion.

CHEMICAL FIRE EXTINGUISHERS.

The Home Secretary was asked in the House of Commons on Monday (1) whether he would put the Public Prosecutor in motion to take action against persons advertising chemical fire extinguishers and other appliances who decried in their advertisements the value of sand or water for use in the case of air-raid fires, and who thereby induced the public to disregard the advice given by the Chief Commissioner of the Metropolitan Police to the sole advantage of the enemy; and (2) whether, having regard to the police advice that water and sand be kept for possible air-raid fires, and that the public should only buy chemical fire extinguishers guaranteed to be made to the specification of either the Board of Trade, His Majesty's Office of Works, the Metropolitan Police, or the Fire Prevention Committee, he would take steps to warn the public against those makers, naming them by name, who advertised the sale of powder extinguishers and other similar appliances which did not comply with the specifications of any of the above-mentioned bodies.

Replying, Sir J. Simon said he had no doubt the public would pay heed to the warnings of the Commissioner of Police as to keeping sand or water in readiness, and not purchase portable fire extinguishers without a proper guarantee. The advertisements referred to were being carefully watched, and further action would be taken in the case of particular makers if this appeared necessary in the public interest.

HIGHWAYS CONSTRUCTION, LIMITED.

One of the most striking displays at the National Road Exhibition is that of Highways Construction, Limited, Finsbury-court, Finsbury-pavement, E.C. The company's stand—as will be seen from our photograph—occupies an excellent position in the hall, and throughout the week has attracted large numbers of visitors, who, in not a few instances, having made their inspection of the materials outside, have found in the charmingly furnished interior a welcome resting-place. Full particulars of the firm's exhibits, we may recall, were given in our issue of last week.

Sand Heaps in the City.—As a precaution against hostile aircraft raids the City of London Corporation has placed heaps of sand, put in the evening into specially made sacks at 200 fixed points, for the purpose of extinguishing fires caused by chemical incendiary bombs.

Stourbridge Gas Prices Raised.—Stourbridge Council have decided to increase the price of gas by 3d. per 1,000 cub. ft. to private consumers, and by 2d. per 1,000 cub. ft. to users for power purposes; 24 cub. ft. for 1d. are to be supplied to slot-meter consumers. Alderman S. Fiddian, chairman of the Gas Committee, mentioned that to slot-meter consumers the increase was only 1¾d. per 1,000 cub. ft.

Preliminary Studies in Bridge Design.—This little book,* a reprint of articles which appeared in The Surveyor and Municipal and County Engineer, is intended as the first of a series of similar volumes which, taken together, will form a treatise on the design of ordinary highway bridges of moderate spans. This first volume goes further back in the evolution of the bridge than do most treatises, and considers the bridge in its essential elements, that is as the means of providing a crossing for man and beast across a watercourse. The bridge engineer is apt to forget this primary purpose and to consider his bridge merely as a framework or a carrier of stresses. Mr. Ryves, in a refreshingly original manner, has emphasised the necessity for studying natural and economic predispositions, one might say, of the bridge site, with a view toward producing, not the best type of bridge, but the best method of getting the river and the traffic across one another. . . . —*Engineering News*, New York.

* By Reginald Ryves, Assoc.M.Inst.C.E. London: St Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s. nett.

CORRESPONDENCE.

ἓν δοκεῖ οὐ πάντ' ὀπᾷ
One man does not see everything.)
—EURIPIDES.

MUNICIPAL ENGINEERING WAR-TIME APPOINTMENTS.

To the Editor of THE SURVEYOR.

SIR,—I am under intimation that my services [as a valuer under the Inland Revenue] will cease at the end of the present month, and I make a strenuous appeal for your esteemed assistance and advice for a move to get back again into something, and particularly something on my own line—surveying, draughtsmanship and supervisional work as particularly pertaining to a district road surveyor's duties or county office. . . .—Yours, &c.,

F. N.

June 21, 1915.

To the Editor of THE SURVEYOR.

SIR,—I notice in your issue of the 25th inst. that you are opening a register of men desirous of assisting local authorities during the war period, and in support of my application have the honour to submit herewith copies of my testimonials and a short *resumé* of my engineering experience, and would particularly draw your attention to the road works and water supply schemes, &c., designed and carried out under my supervision. . . .—Yours, &c.,

R. A. W.

June 26, 1915.

To the Editor of THE SURVEYOR.

SIR,—As a young married man I must protest against the leading article in THE SURVEYOR of yesterday's date.

If I read aright, you propose to compile a list of retired officers who will be willing to assist councils who are requiring additional help owing to depleted staffs, the members having joined the Forces.

Perhaps it has not occurred to you that there are a great many men who are in the unhappy position of having to find employment during this trying time, owing entirely to the cessation of operations by councils during the war. A great number of these men are willing to join the Forces, but are unable to do so owing to those dependent upon them.

In my own case I am a young married man, with one child and a widowed mother to support. Owing to the complete holding up of works during the war, I am under notice, which expires on the 30th inst., and am now looking for employment. If your proposal is taken up by councils requiring help there will be no need to advertise the vacancy, with the result that many like myself will find the competition for the posts that are advertised very keen.

I would respectfully suggest that your proposal to register men willing to help should include those like myself, who are very hard hit owing to the force of circumstances.—Yours, &c.,

PLOUGHBOY.

Kingston-on-Thames.
June 26, 1915.

[Our correspondent will notice that the suggestion as to retired officials was not ours, but emanated from the Local Government Board. While we think it was quite good, as far as it went, we consider it obviously only reasonable that it should not exclude such cases as that of our correspondent, and we shall be glad, therefore, to register on our list his name and the names of others similarly "hard hit," and to forward them to local authorities who notify us that they have engineering vacancies.—Ed. THE SURVEYOR.]

To the Editor of THE SURVEYOR.

SIR,—I am very pleased to see the first item in your "Minutes of Proceedings" this week. I had been wondering what could be done to bring together local authorities, &c., requiring engineering services, temporarily or otherwise, and retired officers willing and capable of serving them, and hasten to submit my name, age, address, and districts last served; and, further, will be pleased to furnish such other information as may be thought desirable to include in your register, or for reference and preliminary consideration by enquiring local authorities. Grateful for your move in this matter.—Yours, &c.,

J. S. H.

June 25, 1915.

To the Editor of THE SURVEYOR.

SIR,—Referring to the notice in the last issue of your paper, I beg to state that I am at present here in the department of the county surveyor, but wish to get a bit nearer London. I would take any position as surveyor or assistant surveyor during the duration of the war. My age (fifty) precludes my being called to active service. . . .—Yours, &c.,

S. N. G.

June 29, 1915.

To the Editor of THE SURVEYOR.

SIR,—Having reference to the first paragraph in your issue of June 25th, I beg to say that I am willing to take almost any reasonable position in connection with municipal or any other work. I have tried to get on with the War Office, but find I am despised as a "civilian," although if I could not have made a better job of the roads on Salisbury Plain than they have (work still incomplete and wretchedly done) in six weeks or two months, I would hang myself as incompetent. I could tell you a beautiful tale, only you wouldn't have the pluck to publish it.*—Yours, &c.,

LATE CHIEF ENGINEER.

June 29, 1915.

[* Try us!—Ed. THE SURVEYOR.]

To the Editor of THE SURVEYOR.

SIR,—Referring to the last issue of THE SURVEYOR, re your article on register of men willing to assist local authorities, I should like to say that, having held an appointment of borough engineer and surveyor . . . for a period of five years, I should like to again become a surveyor to another authority, but permanent.*

I am beyond military age—over forty—and in good health, so I am an exception to what the Local Government Board say.—Yours, &c.,

B.

June 29, 1915.

[Our correspondent would, we think, be well advised to take at once, if offered to him, an appointment for the duration of the war. This will at least give him time to "look round," and when the happy cessation comes there will, it is almost safe to assume, be a pressing demand for engineering officials, in view of the arrears of postponed works which will have to be overtaken.—Ed. THE SURVEYOR.]

REFUSE DESTRUCTOR CLINKER IN ROAD WORK.

To the Editor of THE SURVEYOR.

SIR,—I notice on p. 796 in the issue of THE SURVEYOR of June 25th that reference is made in the column headed "Things One Would Like to Know" to the utilisation of refuse destructor clinker for road surfacing by Mr. E. J. Lovegrove, borough surveyor, Hornsey.

It may interest you to know that in August, 1905, I resurfaced a road in this town with refuse destructor clinker mixed with prepared tar. The experiment proved so successful that I have now 12 miles of roads on this system.

The road first laid ten years ago is as good to-day as when first put down, and has been tar-painted with fine Guernsey granite chippings every two years.

This is found to be "a cheap form of road construction," as the highways expenditure during the last ten years has not been materially increased, while the reduction in street watering and cleansing is considerable.

It would not have been possible to put down 12 miles of ordinary tar-macadam without a serious increase in the expenditure on highways.

The fine clinker residuum, after screening, is also mixed with prepared tar, and has been successfully used in paving promenades and footpaths in pleasure grounds at a low cost.

I may mention that one of your contemporaries was rather sceptical about the experiment when it was first made. Yours, &c.,

FRANK ROBERTS, ASSOC.M.INST.C.E.,
Borough Engineer and Surveyor.

Worthing.
June 28, 1915.

Rhymney Valley Sewerage Scheme.—Notwithstanding a shortage of labour owing to the war, considerable progress is being made with the work of constructing the Rhymney Valley sewer. The scheme, which will cost £250,000, will serve a population of about 120,000 and drain the whole of the valley.

The Use of Motor Vehicles in Haulage of Materials on the Highway.*

By F. W. SMART, Chief Assistant to County Surveyor of Bedfordshire.

During the year 1911-12 the Bedfordshire County Council erected a highways depot in Bedford principally for the manufacture of tar-macadam.

The town of Bedford is so situated that, for practical purposes, it may be taken as being in the centre of the county. There are 735 miles of main roads directly maintained by the county council.

The tar-macadam plant commenced work on April 1, 1912, and the annual output of manufactured material was about 12,000 tons. It at once became apparent to the Highways Committee that some means must be provided for the conveyance of this material and tar, slag dust, &c., to the various parts of the county, as past experience had taught that hired lorries were both expensive and disappointing. After full consideration the county council decided to purchase three 36-40-h.p. petrol lorries from Messrs. Commercial Cars, Limited, of Luton.

The deciding factors in favour of petrol lorries as compared with steam lorries were as follows:—

Speed of 8 or 12 miles per hour as against 5 miles, and consequently a greater daily mileage and no waste of time in taking in water.

Trouble with tubes and boiler of steam lorry.

Petrol lorries are not affected by weather conditions to the same extent as steam lorries, especially during the winter months if the steam lorry has steel tyres.

Less damage to roads by rubber tyres than by steel tyres, which does not, of course, apply in the case of a steam lorry with rubber tyres.

One man only is required on a petrol lorry as against two for a steam lorry.

Convenience of petrol compared with coal fuel.

The three lorries have, up to date, travelled 39,284, 28,824, and 29,944 miles, and have conveyed 11,617, 13,192, and 9,599 tons respectively, and the author regrets that the detailed costs for the year ended March 31st last are not yet completed; so the workings of the lorries for the year ended March 31, 1914, have been taken, and are as follows:—

Capacity of body, 5 tons. Body end-tipping worked by hand gearing on either side.

Item £1,130 0s. 4d. is made up as follows:—

	£	s.	d.	
Petrol, oil, grease, &c....	461	1	7	(or 5·26 miles per gall
Tyres	239	10	0	(or 1·63d. per mile).
Drivers' time	232	0	10	
Depot and establishment charges	63	19	4	
Insurance	45	0	0	
Spare parts	33	7	5	
Labour for repairs ...	27	8	6	(exclusive of driver's time).
Sundries	27	12	8	
	£1,130	0	4	

Depreciation is written off at the rate of one-seventh the total cost each year.

It will be noted that the cost per working hour is 45·8d., and this figure, and not the cost per ton-mile, is the one taken as a basis for the allocation of the amounts into the main road general abstract books, the time-sheets giving the exact numbers of hours, and so avoiding the difficulties of measurements which would be necessary if the basis were per ton-mile. Daily sheets are supplied to each driver, and the mileage recorded by a mileometer and the sheets are checked by the stores clerk.

The cheapest steam lorry hired in this county works out at 50s. per working day of ten hours, and experience proves that one of the council's lorries can convey an equal quantity of material and cover the same distance as the hired lorry and trailer.

Analysing the above detailed costs, it is found that the lorries have each worked an average of 2,528 hours, and, taking the number of working hours at 54 weekly, it will be seen that the lorries have remained idle an average of 280 hours, or 28 working days, inclusive of holidays.

In order that the county council may convey road material by their own lorries on to any cartage length the following clause is inserted into each cartage agreement:—

"The county council reserve to themselves the right to cart tar-macadam or other materials from the county council depot to any length of road, and to cart by their own motor lorries from any station to any length of road."

Schedule Showing Detail Costs of Motor Lorries.
April 1st, 1913, to March 31st, 1914.

No. of lorry.	Working Hours.					Mileage covered.	Number of loads carted.	Weight of loads carted.		Materials.			
	Loading.	Outward journeys.	Unloading.	Inward journeys.	Total.					Petrol	Motor engine oil.	Gear oil.	Waste.
								Tons.	Cwt.	Gals.	Gals.	Gals.	lb.
1	959	620	389	578	2,546	14,123	946	4,771	9	2,546	128	31	2
2	1,075	539	461	482	2,557	9,049	1,109	5,544	3	1,890	121	31	
3	977	579	386	539	2,481	12,024	1,009	5,063	13	2,256	130	19	7
	3,011	1,738	1,236	1,599	7,584	35,196	3,064	15,379	5	6,692	379	81	9

No. of lorry.	Materials (contd.).						Cost of labour, materials, tyres, spares, &c.	Depreciation of capital.	Total.	Cost per ton mile.	Cost per working hour.
	Cloths.	Cylinder oil.	Paraffin oil.	Grease.	Carbide.	Tyres.					
	lb.	Gals.	Gals.	lb.	lb.		£ s. d.	£ s. d.	£ s. d.	pence.	pence.
1	18	6	8	139	20	11 new tyres	394 4 10	105 15 9	500 0 7	3·37	47·1
2	14	1	11	76	21	inter-changed	351 10 0	105 15 9	457 5 9	4·85	42·9
3	19	8	8	66	27		384 5 6	105 15 9	490 1 3	3·90	47·4
	51	15	27	281	68	11	1,130 0 4	317 7 3	1,447 7 7	3·93	45·8

Total cost of each lorry, inclusive of all fittings, £722 3s. 4d.

* Paper presented at the annual meeting of the Institution of Municipal and County Engineers in London last week.

In a county with a large mileage of main roads, and with only three motor lorries, it will be seen that the surveyor can so arrange to cart road material on to the road lengths for which there was no competitive tendering for cartage, and so save considerably. For example, in the northern part of this county some of the cartage lengths are 6 miles from the nearest station, and the lowest cartage tender is 5s. 6d. per ton, and frequently that carter has only one team available. Apart from the serious inconvenience of being unable to get the material carted just when it is required, if, say, 200 tons of material were required for that length, the cartage cost by horse labour would be £55, whereas a lorry, if provided with two men to help fill and empty and convey 20 tons daily to that length 6 miles from the station at a total cost of £22 1s. 8d. (based on 45·8d. per hour plus 6s. per day for two men), which sum is less than one-half of the cost of horse haulage.

All such road lengths as these are earmarked, and the material for same is not ordered until the tar-macadam work for the season is completed and the lorries are available for work outside the depot.

When leaving the depot on the Monday sufficient petrol for the week is taken and stored in a convenient place near where the lorry is to work, and no difficulty has been experienced in finding suitable storage for either petrol or the lorry.

In comparison with horse haulage in this county the cost is from 6d. to 8d. per ton-mile for horse haulage as compared with the lorry price of 3·93d.

For a comparison of lorry *v.* railway freightage a typical case in this county is as follows: Dunstable is a town about 20 miles from the depot, and the railway rate is 4s. 8d. per ton, or, for 20 tons, a total cost of £4 13s. 4d., to which must be added a cartage rate on to the job of, say, 1s. 6d. per ton, making a total of £6 3s. 4d. A lorry can convey 20 tons in two working days at a cost of £3 16s. 4d., or a saving of 2s. 4d. per ton, or £117 on 1,000 tons of material conveyed. The 4s. 8d. rate is certainly very high, and is accounted for by the traffic having to pass over two companies' lines: but, taking the rate from the depot to Luton (direct route on the Midland Railway), the railway rate is 3s. per ton, and upon the same basis as above it is found that by the use of lorries a saving of 8d. per ton, or £33 on 1,000 tons of material delivered is affected. These figures appear very small, but when a full year's working is taken into consideration the total saving is very apparent.

On Saturday mornings, from the very outset when the lorries were new, a practice has always been made, no matter how busy, for each lorry to take out one load only, or two if the work be close to the depot, and devote the remainder of the morning to washing down, cleaning, oiling and generally overhauling, and experience has proved that it is most essential and economical to have a weekly overhaul.

With regard to the running of the lorries, the engine of the first one purchased was not taken down until it had run 22,000 miles, and then only because it was considered time for a general overhaul. The engine, gear-box, &c., were in splendid condition, taking into consideration the distance the lorry had run. The most serious troubles to contend with were tyres and broken ball-races in the back driving wheels. The guaranteed tyre mileage of 10,000 miles could not at first be obtained from the twin tyres of the driving wheels, and it was nearly two years before the best make of tyres to suit the particular class of traffic and lorries was ascertained. Front tyres have always run 20,000 or more miles, and now twin driving wheel tyres are still running which have travelled 14,000 miles, and are good for another 1,000. With regard to the broken ball-races, these usually broke when the lorry was constantly upon very rough ground, such as gravel haulage from pits or on a particularly rough and hard piece of road. At the time the lorries were purchased only two single ball-races were fitted to each hub; but it is possible now to have either a hub with two double ball-races, or roller in lieu of ball-bearings. Either of these, if fitted, will practically eliminate all hub troubles.

With respect to petrol supplies, the author is quite convinced that buying in bulk and having storage tanks with automatic apparatus for filling into the lorry tanks is the most economical method of handling petrol when several lorries are in use. The question of the particular make of spirit to suit the lorry is also a most important one. The price of the various spirits of reputed same grade by different makers hardly varies, and in order to deal fairly with the matter it was decided to carry out a test by actually running a load over a certain route on one spirit and repeating the journey on another spirit. This test was carried out on two occasions, and it was found that a mileage of 4·34 and 6·42 per gallon respectively could be obtained from what were apparently the same grades of spirit, and at the same price per gallon.

In rural districts at the present time it is almost impossible to obtain competitive tenders for horse haulage, and the Highways Committee were so satisfied as to the economy of the petrol lorries that at the last meeting they were fully prepared to purchase another lorry for work during the present season; but, in view of the fact that the makers could not promise delivery within nine months the purchase was postponed.

In conclusion, it is the author's opinion that it is practical economy all round for a county council to own its own fleet of lorries, as the surveyor has a direct control over the drivers, who very quickly take an interest in the work, and are thus a direct means of communication between the depot and office, and all the various gangs at work in the county. The surveyor can ascertain daily the exact quantities that each gang is dealing with, and can be assured that all orders given overnight will be carried out the following day in accordance with the instructions given.

WOOLWICH BOROUGH ENGINEERSHIP.

APPOINTMENT OF MR. LESLIE ROSEVEARE.

Mr. Leslie Roseveare, M.INST.C.E., borough engineer of South Shields, was on Wednesday night appointed borough engineer and surveyor of Woolwich, at a salary of £500, rising to £650, in succession to the late Mr. J. Rush Dixon.

Mr. Roseveare received his education at Wycliffe College, and commenced his professional career in engineering workshops on engine, pump and general machine work. He was then articled for three years to Mr. Edward Sandeman, engineer to the Plymouth waterworks, and was subsequently that gentleman's assistant for two years, this period covering the construction of the Burrator reservoir. Next he was engaged under the borough engineer and surveyor of Plymouth in general borough work and in taking tidal gaugings and preparing details for a large main drainage scheme. As assistant water engineer of Torquay he prepared the Parliamentary plans for the purchase of the Torquay watershed, and in 1898 he became general assistant to the borough engineer and surveyor of Plymouth, having under his charge street improvement schemes, main roads, parks, and all special works. In 1902 he was appointed chief assistant and acting deputy, and placed in charge of the entire sewerage system, bridges, engineering design, Parliamentary works, and the tramway system. In 1904 Mr. Roseveare proceeded to Birmingham as assistant city engineer and surveyor, succeeding, in 1907, to the chief assistant engineership of that city. Two years afterwards he received the appointment of borough engineer and surveyor of South Shields, where he has remained to the present time.

Besides being a member of the Institution of Civil Engineers by examination, Mr. Roseveare is an associate-member of the Institution of Mechanical Engineers, a member of the Institution of Municipal and County Engineers by examination, and a member of the Concrete Institute.

Kidderminster Drainage Loan Refused. — On Wednesday at a meeting of Kidderminster Town Council, it was reported that the Local Government Board had refused to sanction a loan for £5,000 which the council has pressed the board to grant for urgent drainage work in the recently added areas of the borough. The board were advised that the sanitary conditions could be improved by temporary work without this capital expenditure. The mayor said the reply brought them face to face with a great difficulty. They could not seriously consider spending £5,000 out of the rates. To carry out the temporary work suggested by the Local Government Board would involve an expenditure of £600 a year at least, and meant accepting Government liabilities, and, personally, he felt they should do nothing in view of the necessity for economy which was being urged on every hand. It was finally decided that the Health Committee should do its best to deal with any special cases that arose, but not to adopt any new principle without the sanction of the council.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The premium for June is divided between

Mr. E. Knight,
Borough Engineer's Office,
Newport, Mon.,

and

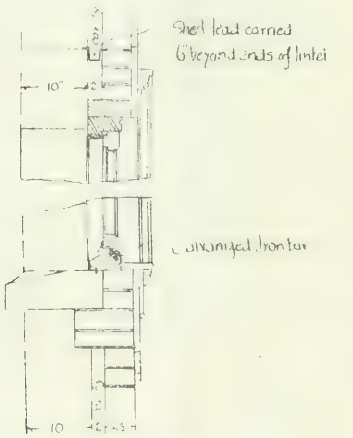
Mr. M. T. Roberts,
Cartref,
Grange-road,
Rhyl,

whose contributions have, in the opinion of the adjudicator, been the best received during the month.

QUESTIONS.

This week answers are invited to the following questions.

489. Road Making. What is the best material from which to make paving setts for use in a carriageway of steep gradients? Give reasons.



Detail plan accompanying Reply to Question 485.

490. Hydraulics. Find the ratio which must exist between the breadth and depth of water flowing in [illegible] channel, of rectangular cross-section, in order [illegible] the velocity of flow [illegible] a maximum.

N. W. K. *Long St. Edmund*

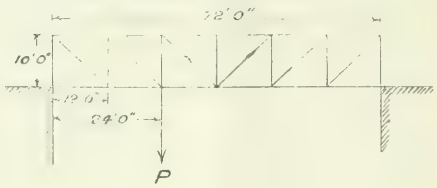
491. Books on Bridge Design.—Please give the name of a thoroughly practical book or books on the design of modern highway bridges. The book or books required must deal with the practical design rather than an abundance of theoretical calculation, and must be up to date. ("Tico.")

492. Hydraulics: Adjoining Locks.—There are two locks side by side. The differential head of water is 11 ft., and the area of larger lock is 200 ft. by 40 ft., and that of the smaller is 120 ft. by 25 ft. The depth of water in cills when the lock is empty is 15 ft. The locks are connected by a sluice-way placed at the bottom of the lock, having an opening of 16 sq. ft. Neglecting friction and assuming the water to fall freely, calculate how long it will take to establish equilibrium with the sluice fully open. What allowances would have to be made in practice? (J. G. W., *Downpatrick.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

485. Building Construction.—A casement window-frame is to be fixed in a cavity wall (10-in. stone facing, an inner facing of bricks, and a 2-in. cavity). Show clearly the methods of fixing, and any important

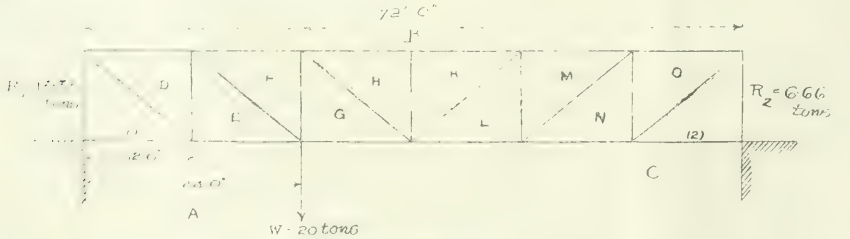


Structures—Fig. 1.

features with respect to the relation between the window-frame and the cavity. (Mercian.)

The cavity should be closed by a double row of brickwork underneath the sill, and on the sides by a vertical row of bats. The casement frame is fixed in the reveals as shown in the vertical and horizontal section of a casement window opening inwards. A channel of sheet lead protects the lintel from any water falling in the cavity. (J. G. W., *Downpatrick.*)

487. Structures.—Find, graphically or analytically, the maximum deflection in a steel lattice girder of the N type, supported at each end, under a load of W tons applied on the bottom boom at a distance of 24 ft. from one support. Span of girder, 72 ft.; six 12-ft. bays; depth of girder 10 ft. Take safe intensity of stress in the members as 5 tons per square inch, and Young's modulus E=13,000 tons per square inch.



Structures—Fig. 2.

The Surveyor
And Municipal and County Engineer.

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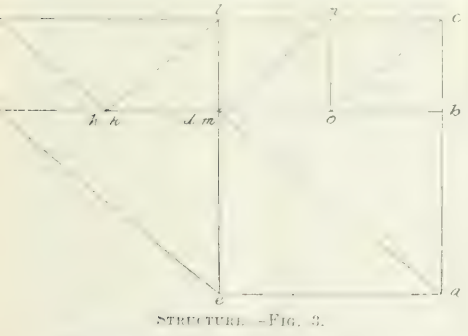
There is no counter-bracing. Neglect the weight of the girder itself. (B. K., *Newport.*)

In all structures changes of length of the separate members are produced by the compressive or tensile stresses in the members, and although the change in length of any individual member is comparatively very small, yet the compounded elongations and contractions of the successive members produces an appreciable displacement of certain points in the structure. The vertical component of such displacement is termed the deflection of that point.



STRUCTURE.—FIG. 3.

Deflection due to Static Loading. Providing the elastic limit is not exceeded, the change in length in any member will be

$$l = \frac{Ls}{E}$$

where L = the original length of the member
l = the change in length of the member
s = the intensity of stress
E = the modulus of elasticity of the material
or if S = the total stress in the member
and A = the sectional area of the member
then $l = \frac{LS}{EA}$

l, L and A, and S, and E, being measured in the same units. Consider the action of the force P applied gradually to the girder in Fig. 1. To produce the changes in lengths of the members forming the girder a certain amount of work is performed. If δ be the deflection of the point of application of P, the work performed during that deflection $= \frac{1}{2}\delta P$. As this is the only external work done, it must be equal to the total internal work done in the girder. The work done in straining any member is equal to half the product of the stress in the member and the change in length $= \frac{SL}{2}$.

$$\text{But } l = \frac{LS}{EA}$$

therefore the internal work performed on any member

$$= \frac{S^2L}{2EA}$$

and the total internal work is the sum of the work performed on each member.

$$\text{Therefore } \tfrac{1}{2}P\delta = \Sigma\frac{S^2L}{2EA}$$

$$\delta = \frac{1}{PE}\Sigma\frac{S^2L}{A}$$

Calculating $\frac{S^2L}{A}$ for each member and dividing the sum of such terms by the product of P and E, the deflection of the loaded joint is obtained. ("Structural Engineering," J. Husband and W. Harby.)

Let us suppose that a load of 20 tons is applied to the girder at a distance of 24 ft. from the left-hand abutment as shown in Fig. 2.

The reaction R_1 at the left-hand abutment
$= \frac{48}{72} \times 20 = 13{\cdot}33$ tons.

The reaction R_2 at the right-hand abutment
$= \frac{24}{72} \times 20 = 6{\cdot}66$ tons.

To find the stresses in the various members of the girder we can make use of the stress diagram shown in Fig. 3. For the purpose of drawing the stress diagram it is necessary to disregard the members marked (1) and (2) in Fig. 2, as no stress at all occurs in them. The stresses in the various members are tabulated as shown, having been obtained by scaling from the stress diagram. The sectional area of each member is obtained by dividing the total stress on the member by the safe stress.

Member.	Stress S (tons).	Length L (feet)	Sectional area. A (sq. in.).	$\frac{S^2L}{A}$
AD	−21	15¾	4½	1634
AE	−16·25	12	3¼	975
BD	+16·25	12	3¼	975
BF	+32·5	12	6½	1950
BH	+24·5	12	5	1441
CG	−32·5	12	6½	1950
DE	+13·33	10	2½	646
EF	−21	15¾	4½	1634
FG	−6·66	10	1½	296
GH	+10·5	15¾	2¼	772
HK	0	10	1½	0
Reaction R_1	13·33	10	2½	646
BK	+24·5	12	5	1441
BM	+16	12	3¼	945
BO	+8	12	1½	338
CO	−10·5	15¾	2¼	772
CN	−8	12	1½	338
CL	−16	12	3¼	945
KL	−10·5	15¾	2¼	772
LM	+6·66	10	1½	296
MN	−10·5	15¾	2¼	772
NO	+6·66	10	1½	296
Reaction R_2	+6·66	10	1½	296
1	0	12	1½	0
2	0	12	1½	0

Total for the whole girder 20330
Multiplying by 12 to reduce L to in. 12

$$\Sigma\frac{S^2L}{A} = 243960$$

$$\therefore \Delta = \frac{1}{PE}\Sigma\frac{S^2L}{A} = \frac{1}{20 \cdot 13000} \times 243960 = 0{\cdot}94 \text{ in.}$$

(L. E. G., *Newcastle-on-Tyne.*)

[Further answers to this question are unavoidably held over until next week.—Ed.]

Institution of Water Engineers.

SUMMER MEETING IN LONDON.—(*Conclusion.*)

Following the proceedings already reported in our columns, attention was given at the recent summer meeting of the Institution of Water Engineers to a paper, by Mr. Henry Dewey, F.G.S., reproduced in our issue of last week, on

THE EFFECT OF SPRINGS UPON WATER LEVELS IN THE CHALK OF EASTERN SURREY.

The President (Mr. F. W. M'Cullough) said they were very much obliged to Mr. Dewey for his very interesting paper. It would be very interesting to those in the neighbourhood deriving their water supply from this particular strata. He proposed a hearty vote of thanks to Mr. Dewey for his paper.

Mr. T. Molyneux (Stockport) seconded the motion, and remarked that the preparation of the paper must have entailed an enormous amount of work which they would all appreciate.

Mr. Baldwin Latham (Westminster) said it was over fifty years since he was first engaged in this very district, so that he thought he knew something about it. The first gaugings he made were in 1866 in connection with a large bourne which flowed down this valley direct into the Wandle. There had not been such a large bourne since that time. The question arose how it was these bournes had been diminished in recent years. The next largest bourne which he gauged was in 1877; but in 1904 they had a bourne almost as large as those in the earlier periods. The view then with regard to the matter was that it was entirely due to the enormous amount of pumping which was taking place in the chalk area round London, and especially in the main district. They had now a large number of waterworks dealing with millions of gallons a day, and naturally one might conclude that they could not expect to have bournes of such great capacity as those they had in former years. He was very much indebted to Mr. Dewey for his information with regard to these fossils and strata, and so on, but he was sorry that he should have taken up Lucas's gaugings, as that had been shown to be utterly wrong. When the South Western Water Bill was before Parliament in 1882, he threw over his tables, as they were shown to be wrong. To give an idea of this. The author stated in the paper that the amount of water flowing away at the springs was 39,156,680 gallons. Mr. Lucas said that 21,246,770 gallons was produced by 43 miles of drainage area, which was the drainage area of Croydon, and that 17,809,910 gallons was produced by 8¾ miles of drainage area. Now it was utterly impossible for that to be correct—that they should have these enormous divergencies between Carshalton yielding a very large quantity and Croydon yielding a very low quantity. Now the relative circumstance at the present day was that the actual gauging of Carshalton exceeded that of Croydon because it was not interfered with to such an extent as the Croydon area had been interfered with. In the first place they had the waterworks of the town of Croydon itself, which raised some 3,000,000 or 4,000,000 gallons a day, and they had an enormous quantity of water escaping into sewers which passed away from Croydon, and did not come into the Wandle again until it had gone through the sewage farm. The consequence was that, if they could add the total quantity of water which was now escaping by the sewers, and which was larger than it was, the relative figure used by Croydon was still larger than it was shown to be. Mr. Lucas afterwards referred to Telford's gaugings. Mr. Telford, in 1833, which was a very low water period, gauged both the branches of the Wandle, and that gauging was very satisfactory, because the gauging which was taken just below Beddington Church, on the Wandle, was given as 17 cub. ft. per second. Carshalton at the same time was given as 13 cub. ft. per second. They would see that Croydon yielded 9,180,000 gallons a day, and Carshalton yielded 7,020,000 gallons a day. Those figures were very much more approximate. There was no such area as 43 miles in Croydon. The total area of Croydon at the present time was 22 miles. It was more, only the making of the Oxted tunnel led away another 2 miles into a neighbouring area, so that it escaped coming into the Wandle at all. The advantage of these results had been that all these gaugings had been published. That in 1853 was made by Mr. Braithwaite, who was a very great authority on questions of underground water, and he did a very great amount of work in regard to the sinking of wells in London itself. Then came the question, where did London wells get their water from? There was no direct communication between the chalk and the London wells. Chemical analyses of the water in London wells showed that it differed from the chalk water. It had been shown by Dr. Thresh that, if water from the Wandle was allowed to filter through the Thanet sand, it produced a water corresponding with that found in these London wells. His own gauging of the Wandle showed that at times an enormous quantity of the water was lost. He had gauged as much as 10,000,000 gallons a day flowing out of the Wandle, and that went to supply the wells under London. Therefore they had to be very careful with regard to this area, as to what area they were dealing with, and what was happening. Then, with regard to the springs on the east of Croydon, many of them were independent of the chalk altogether. One flowing through Addiscombe went into the Wandle, but not before it got to Merton, and there were other streams which were mostly tributaries of the river Ravensbourne. In fact, the Ravensbourne was said to have taken its name from the fact that a Roman army was encamped and was short of water, and a raven was seen to go to a particular spot, where the Romans found a spring. He was very much obliged to Mr. Dewey for the information he gave with regard to geological fossils, and he hoped he would continue his labours, and do something to help them get correct gaugings with regard to these flows. In a very large number of areas in which he had been engaged he found, on the average, about 40 per cent of the rain had passed off in this Croydon area, and not one-sixth. But averages were no good in a thing of this kind. They had to deal with the minimum, and the minimum was often only about one-tenth of the maximum. They had to find out which was the minimum. The Royal Commission on Water Supply were not very far wrong when they put down the minimum flow at 3½ in. on the drainage area.

Mr. W. Whitaker (Croydon) said there was a distinct difference geologically between the two areas divided by the Croydon valley. It was not wholly a geological difference—it was partly a topographical one. As a matter of fact, the eastern area, so far as regarded the junction of the tertiary beds and the chalk, was what they might call a high-level area, whereas the western area was a low area. The junction of the tertiary and chalk came at a low level on the west and a high level on the east. That was one reason why they got springs on the west and not on the east. The consequence was that between the two valleys—the Croydon valley and the Ravensbourne—they got practically no springs along the line except that the Ravensbourne itself was in the nature of a bourne where it flowed now, whereas on another side they got a regular succession of springs all along. He had tested over 100. They did get springs in the high level of the western area, but they were springs out of the tertiary beds. So they had springs in the west, and on the east they got smaller holes due to the conformation of the country, and this was due very largely to the occurrence of this great mass of pebble beds which made up the brown area on the map. They did not go beyond the Croydon valley. They came out of it on the east, and then there was a sudden ending off. This sudden ending off was a very curious thing, and it had a marked influence on the topography. They got this high level on the lower tertiary area, which was high and dry because of the pebbles. That had a wonderful influence on the topography, and topography had an influence on water in a particular region. Now, as to the increase of borings, he had no doubt they had increased, and there was no doubt when anything went wrong it was the wicked water engineers who were to blame. But the extraordinary thing was that, with the amount of water pumped off the whole of this area, both east and west, lowering the water level in the neighbouring wells, of course, that year after year, at intervals, bournes still broke out, and the water overflowed. They went on pumping, but they could not stop the bournes altogether. The bournes might not be so big as they used to be, but they were there, and were big

enough for all practical purposes. He thought Mr. Lapworth had said Croydon used a week, and his highest gave 11,250,000 gallons a day, or, to put it roughly, 12,000,000 gallons. Despite all the pumping that the wicked water engineers had done, when Nature took a little her hands to give 2 in. or 3 in. more rainfall they got this. Undoubtedly there must be an effect from the pumping from the chalk, but the effect was not so great as some people made out. Sometimes it was large, but Nature was quite able to deal with it, and if by any climatic change they got an increase in the average rainfall of an inch or two a year, things would be very different indeed; and they knew such things had been. They had fair evidence that in Roman times there was a heavier rainfall because there was a higher water level, where there was no pumping and no engineers to alter it. If Nature took it into her head, as she may perhaps do, to vary the average rainfall—which did not keep a steady thing for 100 years—their remote progress might revert to a different state of things, and then, instead of seeing these bournes, they would see, perhaps, a few more pumping stations pumping more and more water, and it was possible that at this distant period it might also see flowing streams where there were now dry valleys. Of course, it became a question of what was the proper use of water. Was it best to allow it to run along, and be to a certain extent wasted, looking very pretty along the valley, or to use it for the great purposes of public supply? He did not know whether it had occurred to them, but it seemed to him that was a question which would have to be seriously taken in hand, and very seriously answered at some time or another.

Dr. H. LAPWORTH (Westminster) said he did not know that he could add very much, but he would like to congratulate the institution and the author on a very excellent paper. He hoped when they had this Government hydrological department this was the sort of work they would take in hand. There was an enormous amount of work in the paper which would be recognised when they considered the labour involved in regard to almost every single figure in the set of tables. There was also a great deal of thought embodied in the paper, but he would not go into that. One point he would like to speak about was that of the annual fluctuations. Personally, he thought that the author's theory was correct, or partly correct, as to the cause of these annual fluctuations. It was a thing well known to all pumping engineers that if they had a stream with underground water discharging into it in the form of springs they had the water rising up and then falling down. The speaker proceeded to demonstrate his point by a blackboard drawing. His contention was that the underground water discharging at the spring did not fluctuate in the water level at the spring itself, but the further they got from the spring the greater the fluctuation of the water level.

Mr. W. PRESTON (Grantham) said he had thought of a similar explanation to the one given by Dr. Lapworth. He wondered whether it was possible for the wells in the chalk on the east side of Croydon to be in any way connected with the springs on the west side, seeing, as the author had explained, that there was some sort of a fold on the northern outcrop of the tertiary. If the fold continued, and crossed the little valley near to Croydon, he wondered whether the water on the east side would travel at a slower rate to the same outlet. It seemed possible to him that, having a common outlet—and they knew that the inlet was common—the variation in the amplitude of the wells would be dependent upon the distances or of friction in the rocks. He would like to know whether there was a possibility of the water on the east side being connected with the water on the west side. There was another point he had noted. The author spoke about this fold, and referred to it as being due to volcanic action. They found generally that on these slopes a good deal of local action went on through denudation, and they got numerous foldings due to the rocks having been removed in one place, and having slipped down in another. Many of these smaller foldings were not due to shrinkage of the earth's crust by original volcanic action, but to more local and recent action on the surface of the rocks.

Mr. DEWEY, in reply, thanked the meeting for the patient manner in which the paper had been listened to. He said he was sorry he had to refer to Lucas's gaugings, and to have heard that they were wrong. He rather suspected that might be wrong, but he had no others to use as it happened. The whole question was as to what caused the difference of the fluctuation of the wells east and west of the valley. That was the point at issue. It was a fact, account for it as they liked. Mr. Whitaker referred to the bournes, and to the effect of pumping on the water level. Well, the water capacity of the chalk was limited, and he very roughly estimated (and he did not think the figures were too accurate) that 50 in. of rain would absolutely fill the chalk so that it could not hold a drop more. That was to say, the bournes would be flowing permanently along the valleys if they had an annual rainfall of 50 in. spread over the year. The chalk would be filled to its utmost capacity. Therefore, if the pumping diminished, the amount of water in the chalk annually for supplies would be fully replenished. It was purely a matter of arithmetic. With regard to what Mr. Whitaker said, the point he wanted to emphasise was that the change of topography was dependent on the change geographically. The author proceeded to point out on the map the tertiary escarpment on the east, whereas on the west it was impossible to draw it, and he also showed where one would naturally draw the line. Both Mr. Preston and Dr. Lapworth had asked whether it was possible that the catchment area came down to the springs to any extent. He thought to a great extent it did.

Consideration was afterwards given ot Mr. Percy Griffith's paper—reproduced in our issue of last week -entitled

HYDRO-GEOLOGICAL CONDITIONS AT NEWBALD, EAST YORKSHIRE.

The PRESIDENT (Mr. F. W. M'Cullough) said he was sure they were all very much obliged to Mr. Griffith for his interesting paper, and he would ask them to accord a hearty vote of thanks to their secretary for his kindness in preparing and reading his valuable contribution.

The vote was carried by acclamation.

Mr. C. B. NEWTON (Hull) said the question of water supply along the escarpment of the chalk of the Yorkshire Wolds was one of extraordinary difficulty. It was found that wherever great masses of chalk rested upon clay beds, as in the Newbald area, the pressure of the weight of chalk upon the clay resulted in the latter being squeezed out, or made into irregular beds, and the chalk strata also were turned upwards and outwards as the clay beneath was thrust forward. In addition to those difficulties, there was an anticline in the central parts of the Wolds, and upon its slopes the new deposits thinned out in a feather edge. In one small quarry not far from Newbald were beds of rias upon which directly rested the red chalk, and upon that again the white chalk—all that occurring within a depth of a few feet; in fact, ordinary geological conditions of water supply could hardly be said to obtain in this area. He thought Mr. Griffith was to be congratulated upon his happy solution of the difficulties of obtaining a water supply for Newbald.

Mr. W. WHITAKER (Croydon) said he would like to congratulate the author on having the great advantage of a map with a greater number of contour lines so that he knew exactly where he was looking. He could not see why these Yorkshiremen should be treated with these handsome maps when the poor fellows in the South only got them one in every hundred, and got very little information. As a matter of fact, the author had not put every contour on the map. He thought the paper illustrated what they must all more or less have had before them occasionally, and this was the great difficulty there was about small water supplies. As a general rule, there was no particular difficulty if one wanted to get 2,000,000 or 3,000,000 gallons a day; but when they wanted to get a supply for a rural district the difficulty came in. The difficulty first was the financial one. The local authorities could not afford to expend £2,000 or £3,000 on experiments. He imagined their secretary must have had a lively time on this job, and occasionally he must have been discouraged; but he seemed to have got over that all right. The paper illustrated how objectionable the ways of Nature were, for when, theoretically, they came to places where they ought to get water, yet when they made a hole and dug down they did not get it. Instead of Nature sending the water nicely and comfortably into where it would be more or less convenient for the water service, she had chosen to send it bang through a hill somewhere or the other, and the consequence was they did not get it where they ought to. Now, it was the business of engineers to put up with these things, and

it was to the benefit of other engineers, when these difficulties and comparative failures were met with, that they should be recorded. His own impression was that they learned more from the failures of others, and perhaps their own, than from successes. He hoped all of them would not scruple to record these things when they did not get success, just as they gladly recorded their successes. It showed they must persevere and go on. They must cut their coats according to their cloth, and in the small rural districts they must not attempt to do what they would in a big district. In the end they came through as their secretary had, and they all hoped he would have a good many ventures of this sort, and come out right in the end.

Mr. H. Preston (Grantham) said they ought to feel very grateful to their secretary for giving a very clear description of a most interesting investigation, and one which showed the advantage of having some general idea of what they might expect from rocks, and of having the power to investigate any variation from that expectation. Relative to the underground streams which the author spoke of, he had himself, on various occasions, found, where he had expected water to be flowing to the west out of the escarpment, that when they had dug into the section the water had been found to be flowing quite at right angles—sometimes in a northerly and sometimes in a southerly direction for a considerable distance. That had been due to the folding of the lower strata of the clay spoken of by Mr. Newton in consequence of the lowering of the higher rocks on the creep on to them puckering up the lower clays and forming a sort of gully. As to the boring the author put down through the hill, he supposed this was stopped just as it had got well into the Kellaways rock. It seemed a pity when a boring was put down into the pervious rock that it should be stopped before they knew all that the boring would teach them. It was advisable on every occasion where it was possible to continue the boring until at least they got to the impervious strata. Unless they did that they could not say the boring was a failure. In this case, apparently, if the author had gone a few feet further he would have got into the oolites and obtained his water. Whether that would be equal to what the author had obtained he did not know, but probably it would have been better, as he was further from the outcrop. On Plate 2 the 12-in. boring down into the oolites looked to him to be something like 200 yds. from the Newbald Beck, and when pumping he found a very large quantity of water. He wondered whether it was possible some of the Newbald Beck got into the oolites, and kept it well supplied with water.

Mr. A. B. E. Blackburn (Sunderland) said he wished to add his thanks to that of other speakers to the author for bringing forward the paper for discussion at this early stage. It was the early stages of the problem which presented difficulties, as the actual construction of the works would follow on without any great difficulty. As Mr. Whitaker had told them, it was the finding of the water for small districts which was so very interesting. As an institution they ought to be grateful for having papers of this description brought forward. It was a very easy matter for members to bring forward particulars about big schemes, but, after all, there was only a very limited number of big schemes, and they sometimes had difficulty in getting papers. He thought the institution should encourage the bringing forward of papers of this character. He might say that, as a member of the Papers Committee of the council, he had had the advantage of giving Mr. Griffith the benefit of his criticisms before.

Mr. [illegible] might all look upon him somewhat as a parent, and at any rate words of commendation and encouragement [illegible] before the institution records of difficulties he had met, whether overcome or not. He hoped that example would be followed, because he personally had found the great advantage of sharing others' difficulties and their ways of getting over them. He had done [illegible] it was only their duty one to another to share each others' difficulties as well as the successes. Mr. Preston had dealt with a technical point in the form of a question. [illegible] under which this boring was stopped so near to [illegible]

in the paper—financial reasons. As Mr. Whitaker had remarked, from personal experience in dealing with these small councils one had, as an engineer, to go very gingerly at every stage of the work. They were not given *carte blanche* power to investigate an area and spend £5,000, and report what had been done. If they got a small council to vote them £100 for experimental work they could think themselves lucky. Then they had to ask for another £50, and so on. He supposed he had spent rather more than that sum on this experimental work, and, although he congratulated himself on obtaining the sum from a rural council, still it had been uphill work to get the money to carry the experiments out on a proper basis. It would have been extremely interesting, and he was anxious to continue this boring, but he was then slightly beyond the limit of expenditure which had been allowed to him, and to have gone back to the council and to have explained all the facts and have tried to induce them to continue the boring was an undertaking which he, with some courage and some perseverance in his nature, shrank from. He went round another way, and got a better result. It was a [illegible] assured in his own mind that the water supply in this boring through the oolites would have been better than it was near to the springs. It was not at all certain as to whether the fissures in this limestone were so uniform throughout in the bulk, and especially down the dip eastwards, as they were near the broken outcrop, and he would rather fear that a casual boring near the outcrop might possibly miss the larger fissures and might have proved comparatively sterile. In the broken area near the outcrop it was obvious one had a better chance. Moreover, as he had pointed out, the essential feature of this supply that they discovered was that it was travelling altogether in a different direction from that of the dip, which was more or less east to west, but was travelling north to south, and the fact that this was on what appeared to be the direct line of that flow, and particularly near the point at which it had been found to escape into the underground stream, because he believed the bulk of this flow ultimately reached the Humber direct underground, and that these large springs were merely the overflow from it. In that event an interesting feature was obvious, which was that the area of chalk which was drained into the underground stream must be very large, and was not by any means the local area. There, of course, they had a very interesting example of what Mr. Preston referred to—the possibility of one boring, and then finding the water travelling in the reverse direction to what was expected. The question as to whether the Beck got into the oolites he thought was quite clear from his local observations. It must have been the other way. The pressure of the underground water was considerably greater than that of the Beck, and the water rose to the surface at a higher level than the Beck. If the Beck had got access to it, what must have happened was that the underground water would have come into the Beck rather than the Beck water getting into the underground stream. There was no doubt [illegible] water was the drainage of a large area some distance away, and was a special area under special pressure due to the chalk wolds. It was fortunate one should have happened on this particular outlet when one wanted it. He might make one general remark upon the area, which was that the particular area round Newbald, including Drewton and Weedley, would, on casual observation, appear to be an ideal spot for [illegible] would challenge that. He was told that engineers, including Mr. Whitaker, many years ago had reported on this question, and said without a moment's hesitation that Drewton and Weedley was obviously the area to go to to supply water. But when one investigated the springs which were visible, and were the natural local drainage and overflow from the chalk outcrop, it was true that one was deceived as regarded the tapping of any large quantity. In fact, the conditions [illegible] it was doubtful whether any tapping of any one of the springs would have been the right source of supply, to say nothing of owners' rights. The finding of an independent supply from a large gathering ground was extremely fortunate, and he thought the investigations which led to it would be interesting to record.

The President proposed that the best thanks of the institution be presented to the Geological Society for the use of their apartments.

Mr. T. Molyneux (Stockport) seconded the motion, and it was carried.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Bristol T.C. (July 29th. Mr. A. W. Brightmore).—£27,295 for the electricity undertaking. It was explained that £25,949 was required to purchase a 6,000-kw. turbo alternator, and the necessary piping and switchgear, and to cover the excess of expenditure of £1,398. Speaking about certain expenditure already made, the town clerk, Mr. E. J. Taylor, stated that, in providing an additional circulating water intake at Avonbank works, a 5-ft. seam of running sand was encountered, which necessitated the abandonment of excavations, and the alteration of the position of the catchpit; and a spring of water was also met, which added to the cost of pumping. The excess of expenditure was £386, which was reduced to £346 owing to more favourable terms gained from the water company. The development of power was increasing so rapidly that it was desirable to instal a large unit of plant rather than several small ones, as being the most economical in cost and expense of working.

Reigate T.C. (June 21st. Mr. F. H. Tulloch).—£19,000 for the purposes of paving, road improvement, the erection of police and fire stations, and the electricity undertaking.—Evidence was given with respect to the various schemes, and it was stated that it was proposed to build the police and fire stations in London-road, Redhill. A sum of £1,000 is required for electrical extensions, £9,200 for paving works, and £2,800 for the improvement of The Common.

APPLICATIONS FOR LOANS.

Hendon U.D.C.—£650 for road widening.

Lymington R.D.C.—£4,000 for works of sewerage.

Lymington T.C. £500 for the purchase of the Sandpit field, and £215 for the improvement of the hospital building.

Sunderland T.C.—£2,500 for the extension of the isolation hospital.

LOANS SANCTIONED.

Bridlington T.C. £2,450 for the erection of workmen's dwellings.

Chester-le-Street U.D.C. £13,672 for a housing scheme.

Hull T.C.—£20,000 for the extension of the generating plant at the electricity works.

Lewisham B.C.—£1,946 for street improvements.

Manchester T.C.—£432,470 for a new electricity generating station at Barton.

Newry Port Sanitary Authority.—£500 for the provision of an intercepting hospital.

Stepney B.C.—£24,000 for electrical machinery.

Stoke-on-Trent T.C.—£9,748 for electrical mains, machinery, and services.

Surbiton U.D.C.—£4,875 in respect of the sewerage scheme.

FORTHCOMING INQUIRIES.

JULY.	£
5.—**Cosford.** For the erection of workmen's houses (Mr. Courtenay Clifton) ...	1,200
6.—**Oakengates.** For works of sewerage (Mr. P. M. Crosthwaite)	1,230
6.—**Peterborough.** For works of sewerage (Mr. H. Shelford Bidwell) ...	5,300
7.—**Skegness.** For private street works (Mr. R. H. Bicknell)	961
8.—**South Westmorland.** For works of sewerage (Mr. P. M. Crosthwaite) ...	220
9.—**Beverley.** For works of sewerage (Mr. A. C. Denny)	—

South Shields Corporation Bill.—On Tuesday the South Shields Corporation Bill was before a House of Commons Committee, of which Mr. Middlebrook was chairman. The Bill, which was unopposed, asked for further powers to be granted to the corporation in regard to their tramway undertaking, to extend their Mill Dam quay, to construct street works, to acquire lands, to make better provisions in regard to the electrical undertaking and the local government, health and finance of the borough, and "for any other purposes."

ARTERIAL ROADS IN GREATER LONDON.

MEETING OF SOUTH-WESTERN SECTION.

A meeting of the South Western Sectional Conference in connection with the scheme for arterial roads in Greater London was held on Tuesday afternoon at the offices of the Local Government Board. Viscount Doneraile occupied the chair, and there were present Sir Alexander Stenning (Surveyors' Institution), Messrs. A. Dryland (Surrey), P. Dodd (Wandsworth), E. Willis (Chiswick), G. Stevens (Feltham), S. H. Chambers (Hampton), G. Jerram (Merton and Morden), J. H. Brierley (Richmond), E. J. Barrett (Staines), M. Hainsworth (Teddington), F. W. Pearce (Twickenham), R. Wilds (Walton-on-Thames), J. S. Crawshaw (Weybridge), A. A. Fillary (District Surveyors' Association), R. H. Aldridge (National Housing and Town Planning Council), W. H. Thompson (Roads Improvement Association), H. V. Lanchester (Royal Institute of British Architects), Colonel R. C. Hellard (London Traffic Branch of the Board of Trade), and G. L. Pepler (Local Government Board).

Proposals of the sub-committee for the continuation of the Brentford by-pass to the Basingstoke Road; the widening of Putney Bridge; the rebuilding of Wandsworth Bridge and the improvement of its approaches; and the construction of a new bridge across the river at Richmond, a short distance below the existing railway bridge were agreed to.

The following recommendations were also approved: (*a*) that the Brentford by-pass should be linked up at its eastern end with a by-pass joining Cromwell-road and other main routes; (*b*) that the line of the proposed Chertsey-road should be fixed, as can largely be done by means of town planning schemes; (*c*) that provision be made for improving the roads leading south through Feltham from Baber Bridge, on the Basingstoke Road, in connection with the proposed western extension of the Brentford by-pass.

MUNICIPAL WORKMEN'S WAGES.

At the April meeting of the Birmingham City Council a resolution was passed raising the minimum wage of all able-bodied male employees of the corporation who have attained the age of twenty-one years from 26s. per week to 28s. per week. This was done in consequence of the higher cost of living due to the war, and at the same time and for the same reason an advance of 2s. per week was given to all employees receiving wages between 26s. and 30s. per week, while those receiving wages between 30s. and 32s. per week were granted such an increase as would bring up their wages to 32s. per week. This advance, added to increases to infirm and female employees, as well as further advances made subsequently in the trading departments, have increased the wages bill of the corporation by about £50,000 per annum.

Still (the *Birmingham Post* states) the employees are not satisfied. Those in the receipt of 31s. per week were raised to 32s. and not beyond that sum, and on their behalf Councillors Simpson and Hallas made an application on April 15th to the Lighting, Stables and Refuse Disposal Committee asking that those employees who are not shift men or artisans whose pay is regulated by the standard rates set up outside trade unions, or who have not profited by the recent advance of 2s. per week, shall receive an advance of 2s., or such sum as will bring the advance to that amount, except engine drivers and stokers, who ask that their wages shall be increased by 6d. per shift; but any advance that may have accrued to them through the resolution of the council on April 13th to count towards such increase.

This matter is referred to in the report of the Lighting, Stables and Refuse Disposal Committee, which is to be presented to the city council at their meeting next Tuesday.

The committee are not prepared to grant the increase, and they recommend that their action be confirmed.

To Manufacturers.—Mr. William H. Eley, engineer and surveyor to the Newmarket Urban District Council, writes: I shall be glad to know through the kindness of your columns of any makers of steam or motor wagons for removal of house refuse, street watering, or general haulage of road materials.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Devon, Leeds, Shropshire; housing and town planning—Berkhamsted; roads and materials—Bolton, Keighley; water, gas and electricity—Barrow, Melton Mowbray, Preston, Wishaw. Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Aberavon T.C.—The formal opening took place recently of the new municipal buildings and arcade, which were built at a cost of £15,000.

Devon C.C.—The council have decided to provide accommodation for small-pox patients at a cost of £1,000.

Easington R.D.C.—The formal opening has taken place of an infectious diseases hospital erected at Thorpe, at a cost of £12,000.

Ely R.D.C.—The council have purchased for £400 a site for the proposed isolation hospital.

Kilmarnock T.C.—Three cottages are to be built at the electricity works, at an estimated cost of £1,300.

Leeds T.C.—Considerable extensions of the educational facilities are contemplated by the Education Committee, including the erection of a central technical school, at an estimated cost of £100,000.

Lymington T.C.—The council have approved the plans of the borough surveyor, Mr. J. Barnes, for improvements at the hospital at Undershore.

Middlesbrough T.C.—At Wednesday's meeting of the Sanitary Committee the tender of Messrs. King & Co. was accepted for the reconstruction of part of the corporation baths, which was destroyed by fire, and about £1,000 damage done, some time ago.—The borough surveyor, Mr. S. E. Burgess, has received instructions to prepare plans for alterations to the tuberculosis dispensary.

Paignton U.D.C.—The sea wall at Preston having been damaged, the surveyor, Mr. C. Owen Baines, has prepared a plan for a new wall set back 100 ft. behind the existing wall. The council have referred the matter to a committee.

Shropshire C.C.—A committee of the council, consisting of Dr. Justin McCarthy, Sir Bowen-Jones, Bart., and Mr. John Anderson, sat at Ellesmere Town Hall on Friday last to inquire into a report by Dr. Wheatley, county medical officer, that the establishment of a joint isolation hospital was desirable for the districts of Oswestry, Ellesmere, Whitchurch, and Wem. There was strong opposition to the scheme. Dr. Wheatley said he estimated the cost of a suitable hospital at between £7,000 and £8,000, and the annual upkeep about £1,000.

West Riding C.C.—A site has been purchased by the Education Committee at Howden Clough for the erection of a council school.

West Sussex C.C.—It is proposed by the Education Committee to enlarge the Littlehampton school, at a cost of £1,198.

HOUSING AND TOWN PLANNING.

Berkhamsted R.D.C.—The surveyor, Mr. H. N. Hedges, has been instructed to prepare plans for a housing scheme.

Berwick T.C.—A scheme is being prepared for the provision of artisans' dwellings.

Greenock T.C.—The tender of Messrs. J. A. McTaggart & Co., Glasgow, has been accepted for the erection of workmen's dwellings in Roxburgh-street, subject to the Local Government Board granting a loan.

Guildford T.C.—It has been decided to build twenty working-class dwellings on a site in Woking-road.

REFUSE COLLECTION AND DISPOSAL.

Margam U.D.C.—The medical officer of health, Dr. J. H. Davies, advises the council to promote the use of sanitary dustbins, and to adopt an improved system of dust disposal.

Paddington B.C.—It has been decided to continue the system of piecework payment for the collection of house refuse under the "tonnage" system instead of under the "load" system, at the rate of 2s. 6d. per ton during the months of October to May, inclusive, and 3s. per ton during the months of June to September inclusive. It has also been agreed to enlarge the vans, as advised by the borough surveyor (Mr. E. B. B. Newton), at an estimated cost of £170.

Southall-Norwood U.D.C.—The council have agreed to accept the suggestions made in a circular letter by the Local Government Board with respect to the storage, collection, and disposal of dust, and the surveyor, Mr. Reginald Brown, has received instructions to submit a report on the subject.

ROADS AND MATERIALS.

Aberdeenshire C.C.—The road surveyor to the Deeside District Committee, Mr. Albert H. Clayton, in a report on road repairing submitted recently, recalled that in his report for last year he had referred to the unsuitability of the present water-bound system of surfacing, particularly on village roads, where, in addition to the through motor traffic, there was also a large local motor traffic, and recommended that a pitch-grouted material be laid on sections of the two main roads in the village of Aboyne similar to the material that was laid in the village of Braemar. The pitch-grouted road laid in Braemar last year had stood the test of a severe Braemar winter admirably, and he had every confidence of the same successful results if laid on the Aboyne village roads. The area he recommended should be laid in Aboyne was 3,500 sq. yds., at the cost of £525, and this amount he had included in the estimate. The committee approved of the report and proposed works.

Bolton T.C.—The borough engineer, Mr. E. L. Morgan, has been instructed to carry out paving works in several streets, and it has also been decided to construct certain streets under the Private Streets Works Act.

Devon C.C.—The Main Roads Committee's report, included a paragraph relating to the risk of actions arising out of accidents on tar-sprayed roads, and a letter had been addressed to all rural councils asking them to indemnify the county council against third party claims. Eventually it was agreed that it should be an instruction to the Main Roads Committee to make arrangements by which councils should be indemnified against third party claims, and that the county council should bear the expense of such insurance.

Falkirk T.C.—The surveyor, Mr. J. Bryce Hamilton, has received instructions to make up Meek's-road, and to submit a scheme for paving at the gasworks.

Greenock T.C.—The question of the renewal of the main street from West Burn to Rue End-street is being considered. The estimated cost, to which the tramway company would contribute £2,300, is £7,300.

Hampton Wick U.D.C.—It has been decided to purchase 4,000 wood blocks for the repair of High-street and Upper Teddington-road.

Ipswich T.C.—It has been decided to purchase a road-making plant.

Keighley T.C.—It has been agreed to carry out new road works, at an estimated cost of £5,300.

Leigh (Lancs) R.D.C.—The surveyor, Mr. Geo. Berry, has received instructions to prepare a scheme for a new road from Higher Green to the Lingards, Astley.

Maesteg U.D.C.—The surveyor, Mr. S. J. Harpur, has prepared a scheme for new road works in several private streets.

Marylebone B.C.—A report has been submitted from the Works Committee with regard to the substitution of motor traction for horse traction in connection with night sweeping and cleansing in the borough. It is recommended that the council should purchase two "Laffly" motor road sweepers at a total cost of £1,300. Information has been obtained by the Works Committee from over forty municipal authorities, some twenty of whom have already adopted motor traction of various kinds. There is a consensus

of opinion that motor traction—either steam or petrol—is undoubtedly superior to horse or manual labour for the purpose, and that a motor sweeper can be calculated to do the work of from three to six times the work of a horse machine. A horse machine travels at the rate of 13 miles for a day's work, whereas a motor sweeper covers from 68 to 90 miles a day, travelling on an average from 8 to 16 miles per hour. Marylebone has 17 miles of streets paved with wood or asphalt, which are washed and swept every night. On an average, to sweep the full width of the roadway, it requires a machine to go over the surface eight times, so that if a machine travelled at approximately 8 miles per hour it would require two machines eight hours each to complete the work. It is estimated that the total saving per night in favour of motor traction is £3 13s. 2d., or £1,331 per year.

Oxford T.C.—The corporation have entered into a contract with the Trinidad Lake Asphalt Paving Company for the reconstruction of the roads in the following thoroughfares: Magdalen Bridge, continuing along Cowley-road to Magdalen-road (exclusive of those parts now formed of tar-macadam), at a cost of £4,785. The approximate area is 13,887 sq. yds. Newroad, from the county hall to Pacey's Bridge, at a cost of £904. The approximate area is 2,613 sq. yds. St. Aldate's, from Blue Boar-street to the other end of Folly Bridge, at a cost of £2,298. The approximate area is 6,411 sq. yds. The total area to be laid under Trinidad Lake asphalt macadam will be 22,911 sq. yds., and the total cost payable on the completion of the work £7,988.

SEWERAGE AND SEWAGE DISPOSAL.

Audley U.D.C.—The council have approved the plans of Messrs. Whitehead & Eales, engineers, for the sewerage of the Chapel-street area, at an estimated cost of £1,300.

WATER, GAS, AND ELECTRICITY.

Aldershot U.D.C.—Consideration is being given to a proposal for the purchase of the Aldershot Gas and Electric Lighting Company.

Barrow T.C.—The Gas Committee propose to carry out improvements at the retort-house and coke yard, at an estimated cost of £2,000.

Bradford T.C.—The electricity undertaking yielded a profit of £18,955 in the last financial year, as compared with £14,905 the previous year. The water department shows a profit of £5,800, against £10,800 last year.

Dartmouth T.C.—The council on Tuesday last approved the recommendations of the Water Committee with a view to carrying out suggestions in the report of Dr. St. George Mivart, Local Government Board inspector, with respect to the water supply.

Horsham U.D.C.—The electric lighting accounts for the year ending March 31st last showed a nett profit for the year of £420.

Ilkeston T.C.—The council on Tuesday last decided that the price of gas should be increased 6d. per 1,000 ft.

Malton R.D.C.—The Local Government Board having approved the proposed water supply scheme for Whitwell, the council have decided to apply for a loan of £900 to carry out the work.

Manchester T.C.—The nett profit of the gas undertaking in the last financial year was £51,159, against £81,126 in the preceding year.

Melton Mowbray U.D.C.—A report is to be prepared on the water supply of the town.

Pontardawe R.D.C.—The Waterworks Committee have been authorised to consider the boring of an artesian well for a water supply for Cwmgorse and Gwauncaegurwen.

Preston R.D.C.—Mr. Percy Heaton has received instructions to prepare a scheme for a new water main and the erection of a water tower to hold 40,000 gallons.

Redditch U.D.C.—Although the nett annual loss of the electricity undertaking is still severe, and has averaged £2,662 per year during the past three years, the actual financial position of the undertaking is reported to have materially improved in the same period. On March 31, 1912, there was owing to the bank and to sundry creditors £2,946. On March 31st of this year the amount owing to creditors was £974, and the bank account was in credit £292. On March 31, 1912, unpaid loans stood at £34,593. On March 31st last this had been reduced to £30,137—a reduction of £4,455—and in addition a sum of £3,000 had, in four years, been paid out of revenue which should properly have been paid from capital. In spite of adverse conditions, no increase in the price of current has been charged to consumers.

St. Pancras B.C.—The Electricity and Public Lighting Committee recommends that the accounts for current supplied to all electricity consumers in the borough, after the reading of the meters at the June quarter, 1915, be increased by 10 per cent, and that the additional charge be notified on the accounts as a temporary one rendered necessary in order to meet the heavy increased cost of coal.

Shrewsbury T.C.—With respect to the electricity undertaking, Alderman Deakin said the statement of the borough accountant was extremely satisfactory. The surplus was £785, as compared with £131 for the previous year. They had not raised the charge for the electric current, and he thought his committee entirely agreed when he said they did not intend to raise it unless they were absolutely obliged, and he did not think they would be.

Southampton T.C.—The council have referred to the Works Committee a letter received from the South Hants Waterworks Company prohibiting the council from using their water for watering the roads in the Shirley and Bitterne Park districts.

Wishaw T.C.—The Glover-West system of vertical retorts is to be installed at the gasworks, at a cost of £4,500.

MISCELLANEOUS.

Pontefract T.C.—The council on Monday confirmed practically in their entirety the recommendations of a committee appointed to go into the question of employment in the departments of the corporation, with a view to economy. The proposals were that the clerk of works at Roall waterworks, at a salary of £3 10s., and a similar official employed at the workmen's dwellings (£2 10s.), should be dispensed with; that the four lamplighters be reduced to two; that the caretakerships of the various municipal buildings be co-ordinated; and that the town crier and toll-collector be dispensed with. Besides these, several labourers and street-sweepers should, it was recommended, be dispensed with. The total reduction of wages suggested was over £1,200 a year—nearly equal to a 6d. rate.

Westminster B.C.—The city council have decided that employees who have been called up or have enlisted for service in the war and are subsequently promoted to a rank which carries pay equal to or greater than their standard salary or wages, and who at the time of promotion are receiving an allowance from the council, shall be allowed half their usual salary or standard rate of wages from the council.

FOR OTHER ADVERTISEMENTS

See End of Paper.

BROADSTAIRS AND S. PETER'S URBAN DISTRICT COUNCIL.

The above-named Council invited Tenders for the Supply of

Ninety Tons of Granite Macadam, broken to a 2-in. gauge, delivered to the Town Depot, Grosvenor-road, Broadstairs.

Sealed Tenders, endorsed "Tender for Granite Macadam," to be delivered at my Office not later than noon on Monday, the 12th July, 1915.

No Tender will be considered unless it is sent in on the prescribed form, which can be obtained from Mr. H. Hurd, C.E., Town Surveyor, and the Council do not bind themselves to accept the lowest or any Tender.

L. A. SKINNER,
Clerk to the Council.

Council Offices,
Broadstairs.
June 30, 1915. (2,624)

WAR LOAN! WAR LOAN!! WAR LOAN!!! Holder of Consols would be glad to hear from holder of War Loan Stock who is willing to help, by loan or hire of the latter, towards enabling conversion. —Box 1,529, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

PERSONAL.

Mr. M. R. Jones, of Abergele, has been appointed surveyor to the Llanfrechfa Urban District Council.

Mr. R. Hogsden, of Southall, has been appointed temporary assistant surveyor to the Uxbridge Rural District Council.

Mr. E. B. Wray, assistant surveyor and building inspector to the Paignton Urban District Council, has had his salary increased by £10 a year.

Mr. R. W. Barlow, of the city engineer's department, Huddersfield, has been appointed road foreman and drain and building inspector of Brighouse.

Lieutenant-Colonel Davidson, water engineer to the Liverpool Corporation, who is commanding officer of the Liverpool Scottish, has returned invalided from the Front.

Mr. Thomas Bull, surveyor to the Thurnscoe Urban District Council, has been appointed inspector for the urban district under the Food and Drugs Act, and under the Petroleum Acts.

Mr. B. Cooper, a senior assistant in the borough surveyor's department, has been appointed deputy borough surveyor of Paddington, in the absence of the borough surveyor, Mr. E. B. B. Newton, on military duties.

Mr. G. H. Dallow, engineer and surveyor to the Halesowen Rural District Council, was on Wednesday appointed borough surveyor of Wenlock, at a salary of £200 a year, with an extra £20 towards the upkeep of a motor cycle or other vehicle. There were 108 applicants for the post.

Mr. W. H. Cousins, surveyor to the Street (Somerset) Urban District Council, has been appointed surveyor and water engineer to the Bridgwater Rural District Council, at a salary of £250 per annum, rising by annual increments of £25 to a maximum of £325, with £50 a year for travelling expenses. There were 198 applications for the position.

Messrs. A. P. I. Cotterell, M.INST.C.E., Bristol, F. W. Jones, ASSOC.M.INST.C.E., surveyor and water engineer, Frome, J. Mathison, F.S.I., surveyor to the Langport Rural District Council, Wm. Phelps, engineer and surveyor, Shepton Mallet, and Edward Stead, county surveyor of Somerset, will take part in the discussion on "Water Supplies to Rural and Small Urban Areas" which will take place at a meeting of the Royal Sanitary Institute at Yeovil Town Hall on Wednesday, the 14th inst.

Mr. Thomas Nisbet was last week appointed to the joint offices of master of works and city engineer by the Glasgow Corporation. The recommendation that the offices should be combined was submitted by the General Finance Committee, and this, as well as the appointment of Mr. Nisbet, was approved unanimously by the corporation. It was referred back to a subcommittee to report on as to the salary for the combined office, and as to the other arrangements necessary to be made for giving effect to the decision, also that the Dean of Guild Court should be entitled, whenever that court considered it expedient, to appoint, at the corporation's expense, an independent man of skill to advise the court on plans submitted by the corporation. The Statute Labour Committee approved of the recommendation to combine the offices of city engineer and master of works.

Mr. F. W. M'Cullough, M.INST.C.E., chief waterworks engineer of the city of Belfast, whose election as president of the Institution of Water Engineers for the year 1915-16 was reported in our issue of last week, is a native of Belfast. Mr. M'Cullough has had a long and extensive practice as a waterworks engineer in nearly every province in Ireland, having been concerned in the design and construction of many provincial waterworks undertakings, but more particularly responsible for the design and construction of the several extensive reservoirs, filters, conduits, tunnels, and other contingent works in connection with the water supply for Belfast, where for the past eighteen years he has been the chief waterworks engineer. He is now engaged in the preparation of the contract plans and specifications for the immediate construction of the extensive "Silent Valley" storage reservoir, to hold 3,000,000,000 gallons, in the Mourne Mountains, some 45 miles due south of the city. In earlier years he was also responsible for the design and construction of several sewerage, harbour, and railway undertakings in Ireland, and is the author of the first scheme for an Irish Channel Tunnel between the County Antrim coast in Ireland and the Wigtownshire coast in Scotland. He has been a member of the Institution of Water Engineers since its formation,

MR. F. W. M'CULLOUGH, M.INST.C.E.
President of the Institution of Water Engineers.

and was elected in 1889 a corporate member of the Institution of Civil Engineers, and for several years past has been a Justice of the Peace for the city of Belfast.

SURREY ROADS.

COUNTY SURVEYOR'S REPORT.

The county surveyor of Surrey, Mr. A. Dryland, in his annual report, states that the programme of road surfacing has been much interfered with owing to the conditions obtaining through the war. The ordinary recoating of surfaces has been impracticable in many cases owing to the difficulty of obtaining delivery of granite, and some of the tar-macadam contemplated is incomplete for the same reason. The special surfacing scheme has also greatly suffered from the same trouble. Owing to the delay in obtaining consents to loans the order for machinery was delayed, and then the war breaking out further hindered delivery, so that a start could not be made until September, valuable summer months being thereby lost. The result is that some 3 miles less of asphalt surfacing was completed in the financial year than was anticipated would be done. The result of this combination of circumstances is that the road surfaces are in a much worse condition than usual at this time of the year, and there is a very considerable under-expenditure upon the estimates, which must not be considered as a real saving, as it will involve a larger future expenditure. Since the estimates were first prepared it has become pretty certain that the difficulties of obtaining material and labour will in all probability prevent the full execution of the programme provided for, and the Finance Committee have, therefore, made provision only for a gross expenditure of £125,421, towards which grants are expected of £38,104, leaving a nett provision from county rate of £87,317. In addition to these figures the sum of £100 has been provided for taking traffic statistics.

Cardiff Street Widening Scheme.—The Cardiff City Council, sitting on Monday as a General Purposes Committee, adopted a scheme for widening Duke-street by a mutual exchange of land with Lord Bute. The adoption of this scheme ensures the withdrawal of Lord Bute's opposition to the corporation's application for a Provisional Order under which they will have compulsory powers to acquire by arbitration, if necessary, the requisite land and premises.

National Road Conference and Exhibition.

THE OPENING PROCEEDINGS.

The formal opening of the National Road Conference and Exhibition took place on Friday last at the Horticultural Hall, Westminster, in the presence of a large gathering.

Mr. Henry Hobhouse, chairman of the Somerset County Council, who presided, stated that, in spite of the war crisis, the County Councils Association, who arranged the conference and exhibition, found there was considerable desire, both on the part of municipal officials and the firms who manufactured materials and machinery, that the event should be held. A good many things had happened in the last few years to bring the question of roads to the front. The Road Board had been created, and it had been spending large sums of money on the roads. The increased volume of traffic had involved a considerable reconstruction of roads and bridges, and it was, of course, important that this money should be spent to the best advantage. It was with the object of bringing together the various kinds of materials used on the roads, and the improved machinery which the new condition of things demanded, that this conference and exhibition had been organised.

Mr. Walter Long, President of the Local Government Board, before declaring the exhibition open, said he observed with satisfaction that several exhibits were closely connected with labour-saving operations. One of the difficulties confronting us for some time would be to secure labour for work that had to be done, and therefore anything that helped in that respect must be of very great assistance. He reminded them of the great changes that had taken place in motor traffic since, when he was last in his present office, he passed through Parliament legislation for dealing with ordinary and heavy motor traffic, and said that if there was one lesson to be learned by users of the roads to-day it was that, in the special circumstances in which we found ourselves, they must be patient, and must be content if they did not find the roads in exactly the conditions which they had been accustomed to in recent years. Motorists, when they met and talked, generally found fault with the roads; they expected the local authorities to do necessary work, and produce excellent roads for them. A Road Board had been created, and large sums of money had been given to the board, which came to them, and not a moment too soon. Governments had a way of giving money and saying "How generous we are!" Unfortunately, they did not stop there, but said, "Having got these sums, you have got to do this, that, and the other," and the perplexed and dismayed ratepayer found at the expiration of a year or two that, although all these millions had been poured out, no relief came to his shoulders because extra grants had been accompanied by extra demands for work and labour. Good roads we must have, and he would appeal to users of roads to remember that even as taxpayers they made an infinitesimal contribution to the cost of roads as compared with the damage they did by the vehicles which they drove. A committee appointed by his predecessor was considering heavy motor problems now, and he thought they intended to extend the scope of their inquiries. "But whatever they do," he said, "I am of opinion that the time has come when we want to reconsider the whole question of motor traffic, and how it can adequately be dealt with. The motor has come to stay. It is in quite a different position from what it was, and I believe it would be the duty of anybody occupying my place, when we are in happier and quieter times, to investigate the whole condition of motor traffic, and to do our best to see that such reforms are passed as will be just to users of motor vehicles, and at the same time just to local authorities and to the ratepayers who find the money." He cautioned local authorities to be patient, resourceful and economical, meantime "conserving all our powers on the war."

Mr. Cyril Jackson, chairman of the London County Council, moved a vote of thanks to Mr. Long.

Sir George Gibb, in seconding, reminded them that the object of such a conference and exhibition was not only how to spend money on the roads to the best advantage, but also how to save money. As one interested in the spending and granting of public money for road improvement, he welcomed every effort which would have the result of testing by experience all the new methods of road making.

FIRST SITTING OF CONFERENCE.

The first sitting of the conference on Monday afternoon at the Horticultural Hall, Westminster, was very largely attended, the capacity of the room in which the proceedings took place being taxed to the utmost.

The Mayor of Westminster, in welcoming the members, said the crowded meeting showed the great interest which the subject they had met to discuss had aroused. He was not an expert in road making, but as a motorist he was interested in roads, and he was apt to compare the roads of one county with another. He knew, however, that under the present circumstances, owing to the dreadful war, the roads, for reasons of economy, were not being kept up as they would be in ordinary circumstances. They were doing all they could to economise in Westminster, and no doubt each of the delegates was trying to do the same in his own locality.

The resurfacing of main roads in tar, pitch and bituminous macadam in the county of Essex was the subject of a joint paper presented by Mr. Percy J. Sheldon, M.Inst.C.E., county surveyor, and Mr. Alfred J. Lyddon, Assoc.M.Inst.C.E., the deputy county surveyor, and the question of the adequacy of bituminous roads was discussed in a paper submitted by Mr. G. H. Jack, the county surveyor of Hertfordshire. The two contributions were discussed together.

Mr. H. T. Wakelam (Middlesex) said that, with regard to the road question generally, one must always remember that procedure must vary in all parts of the country, because the geological and climatic conditions of England were so variable. The choice of materials also must vary widely because the geological formation on the western side was absolutely different to that of the eastern side. On the western side the practice was altogether different, because the materials were to hand for making splendid roads, whereas the east had to depend on Midland quarries or on quarries from across the water. The Herefordshire roads were quite typical, as regarded their construction, of the roads of other agricultural counties of England. It was no use thinking that the county councils of the agricultural counties could afford to spend 8s. per square yard plus 2s. 3d. per square yard for ten years for maintaining their roads, for it was out of the question. The work of foundations, in his opinion, was the fundamental portion of the construction, and until they got a solid and good foundation, no matter what their surfacing material was, their money, in connection with resurfacing, would be thrown away. The traffic in different parts also varied, and they could not deal with the roads in agricultural counties as they dealt with them in Middlesex. In many agricultural districts the roads could not carry more than about 150 or 200 tons of traffic per day, whereas in Middlesex they had roads carrying 8,000 or 10,000 tons of traffic per day. Bituminous roads could be carried out at a less cost than 8s. per yard, but they were not always satisfactory. It was now over thirty years since he began to experiment in connection with tar-macadam and bituminous roads, and he had had a large number of failures and some successes—successes chiefly with slag, limestone and whinstone—and he had also made a good tar-macadam road with granite. The chief point in connection with tar-macadam roads as practised in agricultural districts was the tar, which, unless it was properly distilled, was not too satisfactory. He had succeeded in getting good results from blue mountain limestone in connection with tar-macadam. Some people deprecated the idea that granite could make a good road, but he differed from them. He had also had very good results from slag, but it would not carry the traffic which granite would, and they must be careful in dealing with it because there were so many variations in connection with the analyses. The sulphur and lime varied so greatly that, unless they were very careful, the slag would be a failure. Not only that, but they sometimes got honeycombed slag, which was often detrimental. Unless the bitumen was also pro-

perly loaded they would have failures. A question of very great importance was that of the contribution of the Road Board towards maintenance. At present they had no power to grant subsidies towards maintenance, and that ought to be remedied at once, because in agricultural districts they were handicapped to a great extent in their work simply owing to the fact that they could not raise the money through the ordinary channels to build up their roads to the requisite standard for carrying the present traffic. Until the Road Board did have that power the ordinary granite road was not going to be superseded by bituminous or tarred roads. The best thing under the circumstances, therefore, was to get the macadamised roads tar-painted each year; and here again they must have the tar properly distilled and the volatile oils taken from it. Many people thought the tar-painting of roads was a very simple matter, and that ordinary sand or beach shingle or road grit or scrapings was going to make a tar-painted surface last a considerable time; but they found that crushed shingle got through the tar by the passage of vehicles, and the surface became a pervious one. Therefore they covered the road with a good coating of clean chippings, which created a film on the road which lasted them in Middlesex from the beginning of June until the end of September. The frost destroyed it in the winter, but they got a dustless road through the dusty season. As to damage by motor vehicles, they had had great difficulties in Middlesex with the omnibus traffic, and they were the first authority to get Parliament to give them power, in connection with the new Great West Road, to make the omnibus company contribute to the maintenance. They had no desire to put any hindrance in the way of commerce or industry, but this was a matter which should be dealt with on a proper basis. With regard to corrugations, where they got a rotary movement on a place they got corrugations. He was absolutely certain that it was vibration chiefly which was the cause of corrugations on their road surfaces, and that the faster the motor and other vehicles travelled the closer the corrugations came together. If they reduced the speed, as he hoped would be done by the new committee which was sitting, they would get rid of the corrugations.

Mr. W. V. Anderson (Winchester) remarked that the great trouble was that of finance If the conference could suggest some way of raising the money to do the work they knew wanted doing it would be of great service.

Mr. P. Dodd (Wandsworth) said the comparison given by the authors was not complete, as they did not give the traffic in tons per yard width of road. Moreover, the initial costs given for the painting did not represent the ultimate annual cost of maintenance. It appeared to him that for comparative purposes they wanted the traffic in tons and the cost at per square yard per annum. They knew what the cost per square yard per annum of ordinary macadam roads was, and also the cost of wood paving, and they could roughly approximate the cost of the roads mentioned in the paper where the contractor gave a guarantee for maintenance; but there were only two cases in which this was done. In one section the contractor quoted 7s. 4d. per square yard, and gave a year's maintenance, and the same cost was given in another section. Assuming that three years was the life of the road, that worked out at 2s. 5d. per yard per annum, which was rather a heavy cost. In his district he had several sections put down of various kinds of bituminous paving, and would like to give the cost per yard per annum. Five sections of road were laid under the direction of the Road Board in the Kingston-road, and he would give the cost up to date where the terms of maintenance had not yet expired. In the cases where the terms had not expired he gave the cost per yard per annum divided into the number of years of maintenance. In one case it worked out at 1s. 2d. per yard per annum, and the traffic was 10·3 tons per yard width per hour. In another case the cost was 1s. 1¾d., in another 11d., another 10¾d., and in another 1s. 4½d. In continuation of these sections he had an ordinary tar-macadam road tar-sprayed. In that case it worked out at 9·4d. per yard per annum. At Putney-hill the road was an ordinary macadam tar-sprayed, and the traffic was 12·2 tons per yard width per hour, and the cost only worked out at 8·5d. per yard per annum. There were other sections, one of which worked out at 1s. per yard per annum, where the traffic was 7·4 tons per yard per hour; another cost 10·7d., and another 11·7d., the tons per yard width being 15·4 and 8·2 respectively. His experience of wood paving was that it worked out at 10·72d. per yard per annum, and it seemed at the present time that wood paving was the best and cheapest paving they could put down if the traffic warranted it. The cost per yard per annum was the most important thing. He had about 168 miles of macadam roads in his district, and even if he paid 1d. per yard per annum that worked out at £10,000. He had had some very successful results with tar-spraying. Last year they spent £17,000 on tar-spraying. In 1906-7 they had 180½ miles of road, and no tar-spraying was done. At the end of March last they had 195 miles of road, but the cost of scavenging had been reduced from £36,402 to £26,136, or a saving of £10,266; watering had been reduced from £10,410 to £3,683, and the number of loads of slop had fallen from 67,722 to 29,428, or less than half. Before deciding on the papers they wanted further experience with regard to this bituminous material—they wanted something between ordinary tar-macadam and wood paving.

Mr. H. T. Chapman (Kent) said they had been proceeding with bituminous surfacing in his county, but, unfortuantely, things were not now normal, and they had to carry on in the best manner they possibly could. He did not think sufficient attention had been paid to utilising local materials. He was sure there were many cases where surveyors were burying valuable materials in the formation of the foundations of roads, whereas local materials, at a smaller cost, would do as well. Mr. Jack gave an instance of putting in a foundation 3 ft. thick of, he presumed, local stone. Probably he would get equally good results if he used clinker or ashes of half that thickness. In soft, yielding clays he had used brushwood with satisfactory results. They had used something like 1,000,000 gallons of tar per year in Kent, but at present they were endeavouring not to use crude tar unless it was dehydrated, and it was causing considerable trouble, although they must assist the Government in any way they could. In his experience some of the crude tars from the gasworks had given equally good results with the refined tars. They must take the cost of roads over a period of years, and where they got concentrated motor-'bus traffic it might be an economical proposition to lay wood paving on concrete, as it would result in a saving in the long run.

Mr. J. W. Horton (Derbyshire) said there was little likelihood of the statutory speed of motor vehicles being reduced. The great evil was not the statutory speed, but the speed at which these vehicles really did run. He knew of motor 'buses in his county running at a speed of 24 miles per hour. He thought it should be the duty of the police to take proceedings in such cases. It was not easy for an author to bring fresh matter up in a paper written nowadays on this subject, but the damage to their roads was progressing so rapidly that it behoved them to learn all they could on these matters. The author of the first paper had wisely refrained from taking on himself the rôle of a prophet, and that was no doubt the reason why he refrained from saying how long the coating would last. They had one instance where the coating, after two years, had to be taken up. The first paper dealt almost entirely with metropolitan roads, and therefore to that extent was not of so much value to those who represented the country districts. Middlesex and Essex had roads with very heavy traffic, and they must not be misled by the figures, and assume that the roads of the country must necessarily follow on the same expensive lines as those of these two counties. What they really wanted to know was what was the best thing to do with the average roads of the country, and not necessarily those immediately around London; therefore they had to keep their minds free from the Essex figures or they would be discouraged and disheartened. He knew that Mr. Wakelam had considerable experience with limestone and slag tar-macadam, but a great many were not in contact with blast furnaces, and did not see the production of slag, and had no clear idea of what was meant by slag macadam. The difficulty was that they must be entirely in the hands of the iron masters who were producing slag from day to day. He had required in his specification that honeycombed material should be picked out, knowing that it could not be done. He knew that some firms professed to produce only the old cold-blast slag, and he knew it was not true. They had to take the modern production, and the hot blast produced a very different material to what used to be the case in years gone by. The old cold-blast slag used to be as good as granite in its wear, but that was not the case to-day. Still, to-day they could

get a good material which, made into proper tar-macadam, was a strong material, and would take a fair amount of heavy traffic. He thought they would be wrong if they assumed they were to be driven to such expensive methods as was stated in the first paper. The annual burden would be so great that the country could not contemplate it for one moment. His experience of grouting material had been very similar to that of Mr. Jack. A short time back salvation was looked for by some from grouting, but that was as far off as ever. Still, although tar-grouting and pitch-grouting were not so admirable as expected, they had learned by their failures, and they knew what to avoid even if they did not know the best thing to do. They were all of one mind about foundations, but to ascertain what foundations were necessary they had to make proper trial holes, which had not been done satisfactorily in the past. He had found out that they must have them much more frequently than every ¼ mile if they wanted reliable information.

Mr. H. W. BOWEN (West Sussex) asked if Mr. Jack would give the cost of the material used. In his table he gave the cost of a 3-in. foundation of Clee Hill tar-macadam at 1s. 2·3d. per square yard. That was much below what they could hope to carry out similar work for in the South of England, and he did not want it to go forward that the surveyors in the South of England were more extravagant than those in the Midlands. He considered it most essential that in future papers they should have the roads classified, and that the cost of material and the wages paid to the men should be clearly and distinctly put forward. A great point in road construction was the draining of the substructure of the road, and he saw nothing in the diagram showing the system of drainage.

Mr. A. W. WARD (Portsmouth) asked what experience gentlemen had had in connection with tar and salt water. He found the tendency was to make the road a greasy, dark mass. The salt in the atmosphere near the sea had a very similar result. One of the principal causes of corrugation was, he thought, the presence of slow and fast traffic on the same road.

Mr. JACK, in reply, said Mr. Bowen's remarks were very pertinent. The price of the material at a station 7 miles from the work was 14s. per ton, and it covered 10 yds. per ton. The prices given in the table had been very carefully considered, and, given the same conditions, such work could be done at that price. The work had been done for two and a-half years, and at present was showing only the very slightest signs of wear on the heaviest traffic road in the county. Mr. Dodd's figures were very interesting, but all these minute details as to the construction of roads could only be of great value to the persons engaged upon roads in a particular district. One of the great difficulties of road making was that the conditions varied so much as regarded traffic, sub-soil and the cost of materials. Mr. Chapman mentioned clinkers for foundations. When at Birmingham he used them extensively with good results; but Herefordshire was not industrial, and there were very few clinkers to be had, but they were fortunate enough to be able to get stone right off the roadside. The great thickness of the stone put in had been mentioned, but they did not put in an ounce more than was necessary. He quite agreed that weight and speed on a road were the essential factors. No one would think of building a railway without ascertaining the weight and speed which was to come upon it, and the same thing should apply to a road. He was agreeably surprised to learn that they were all of the same opinion about foundations, for it was not always so. A few years ago a great many thought the Millennium had arrived by merely tar-painting surfaces. He did not say that trial holes should only be taken every ¼ mile, but that the conditions varied, and, as a matter of fact, his trial holes were taken at distances of 20 yds. As to drainage, they had put in many agricultural drain pipes surrounded with rubble, but they had not all been uniformly successful, for the reason that the passage of water from dense clays was so slow as to render ordinary drains, in many cases, ineffective.

Mr. A. J. PRICE (Lytham) said he had done a fair amount of tar-painting, and in connection with tar-macadam roads, and had had some experience with salt water, which they used for street watering. He always made it a rule never to salt-water any road he was going to tar-paint for a fortnight previous, because it had a bad effect on the tar. He did not think the salt in the atmosphere had any effect on the tar. He had some very good tar-painted roads along the front, and it had no effect on them.

Mr. B. S. NEWCOMBE (Warrington) was surprised more had not been said as to the value of subsoil drains. He had to look after a very wet, flat district, which was very difficult to drain. He was able to obtain a good supply of cinders, and he found that 6 in. of cinders under the roads effectively drained it. If they were to put a concrete bed on the soil the traffic would push the whole thing down. He thought it would be a great advantage to dress a tar-macadam road with limestone chippings, not so much for the purpose of repair, but to throw off the heat and keep the road cooler.

Mr. LYDDON, in reply, said the cost of wood paving in Essex was 1s. 2d., and they could not do it at anything like 10½d. Most of the roads he dealt with carried a load of 10 to 15 tons per yard width per hour. In many of their roads the trial holes were dug every 150 yds., and careful records made of the foundation. What answered in Warrington he was afraid would not do in Essex. They had to go deeper, and put in reinforced concrete.

(To be continued.)

LONDON'S WATER.

DR. HOUSTON'S ELEVENTH REPORT ON RESEARCH WORK.

Reporting to the Metropolitan Water Board, the Water Examination Committee of that body state that they have had before them the eleventh report by the director of water examination, Dr. Houston, on research work. The committee observe that the report appears to be not only of scientific interest, but of great practical importance.

The first part of the report deals with the lime experiments at Sunbury, and the committee draw the attention of the board to the director's summary of conclusions. Continuing, they say:—

"It will be seen that, by adding less than 1 lb. of lime to 500 gallons of raw Thames River water, the following remarkable results were obtained: The water, before it left the first tank, was greatly improved as regards colour and turbidity, and the total number of bacteria was reduced over 99 per cent.

"The B. coli results were specially worthy of note, for, whereas the raw river water before treatment contained B. coli in 1 c.c. in 41·2 per cent of the samples, after treatment there were no B. coli in 10,000 c.c.

"The director considers that such a water could not conceivably have contained any of the microbes of epidemic water-borne disease (*e.g.*, typhoid fever), and he concludes with the following strong statement: '. . . no hesitation is felt in expressing the opinion that river water, no matter how impure, may be brought into a condition of absolute safety bacteriologically, and of great relative purity chemically, by means of lime.'

"We note with interest that there seems some ground for believing that the lime treatment is effective in dealing with algal-infected waters.

"We are convinced that lime, when used in slight excess, can render most impure water safe for domestic use. As regards the practicability of the process on a large scale, we endorse the cautious statements made by the director. There can be no doubt that in the case of very soft waters sterilisation by means of lime is both a satisfactory and an extremely cheap method of purification. In the case of hard waters the cost is admittedly serious. On the other hand, the advantages to the consumer of a soft water are so material that it is, perhaps, a debatable question whether the process may not come to be regarded as a financially sound proposition. The whole question, in our opinion, is deserving of further investigation.

"The second part of the director's report deals with the critical study of microbes in the London waters, which might conceivably be mistaken for true cholera vibrios. There can be no question that the world-wide war now raging increases very appreciably the risks of epidemic water-borne disease. The director had previously shown that his methods can detect the presence of cholera vibrios artificially added to water. He now shows that, in the absence of cholera infection, there are no microbes normally present in the London waters which can pass the mesh of his tests and pose as true vibrios. By his comprehensive study of the 'normal' the director is in a position to discover the 'abnormal,' should such a contingency ever arise."

Accompanying the report is an index to the previous ten reports.

Road-making in Warwickshire and Worcestershire.

TWO BIG RECONSTRUCTION SCHEMES.

Quite recently a representative of this journal had the pleasure of a tour in Warwickshire and Worcestershire, in both of which counties the adaption of the main roads to meet modern traffic conditions is proceeding apace, the respective county councils having undertaken comprehensive schemes of reconstruction of their important trunk roads.

Our representative's tour of inspection was undertaken with the acquiescence of the respective county surveyors, Messrs. John Willmot and C. F. Gettings, and we thought that the particulars of the work which is being carried out, supplemented by our own observations on the work, would be of great interest to our readers. It is a journey worth undertaking by those who are interested in the subject of road construction, and we apprehend that there are very few readers of The Surveyor and Municipal and County Engineer who are not. In the case of both counties the schemes, while undoubtedly desirable, were rendered feasible undertakings by substantial assistance from the Road Board by way of grant and loan free of interest.

In Warwickshire our start was made at Birmingham, through the much-extended area of this city by way of the main Birmingham—Stratford-on-Avon road. The reconstruction work commences at the city boundary, and has been finished for a distance of 6 miles to Hockley Heath. Residential suburbs continue on for some distance, and the road then opens out into the country. A motor-'bus service is in operation, and in addition there is a fairly heavy ordinary motor, motor and steam lorry, and general traffic. Parts had been finished nearly two years, but we could see no appreciable difference between the old and the new work. We found a smooth, impervious surface, uniform throughout. Turning off the main road at Hockley Heath, we cut along rural roads until the Birmingham—Warwick road was picked up at Knowle, a growing and exceedingly attractive residential suburb of Birmingham. Within the area of Knowle the main road is known as Station-road, and an attractive job has been made of this road, as, in addition to the other work of reconstruction, both sides of the road have been kerbed and the footpaths reformed with ashes, which, we understand, are to be coated with slag chippings and tarred. Through Knowle we journeyed for several miles over finished work, and were again struck with the uniformity and excellence of the surface. The Birmingham—Warwick road is subject to very much the same traffic as the Stratford road, having also a motor-'bus service. Our guide then piloted us to the main Birmingham — Coventry road, which is certainly one of the heaviest trafficked main roads in the Midlands, running on, as it does, through Coventry to London. All descriptions of motor and steam vehicles are to be met with, there being several through services of heavy motor lorries from Birmingham to London, and motor omnibuses, lorries and motor cars of all descriptions. The road is also largely used by drivers of test cars, both from Birmingham and Coventry works. Prior to the commencement of the scheme, several disconnected lengths of "Tarmac" had been already laid down, and the scheme includes the linking up of these lengths, so that, when the work is complete—and this happy day is fast approaching—the road will be laid with "Tarmac" from end to end (with the exception of two or three sharp gradients) —a distance of 12 miles. We had on this road the opportunity of inspecting "Tarmac" which has been under severe service conditions for a number of years, and a word of praise is due to the county council for the excellent result which they have achieved with this material. Uniformity and reliability were two qualities which impressed our representative, who was also struck with the handsome appearance of the road —long, undulating stretches, 24 ft. wide, lined out well, and with a riding pad and ditches either side. Work is in progress at Meriden, some 6 miles from Coventry. Passing through Coventry we continued on the Coventry—London road. On this road again stretches of "Tarmac" had already been laid prior to the commencement of the scheme, which again included a series of linking-up lengths. From Coventry to the county boundary at Willoughby—a distance of some 14 miles—the whole of the surface is "Tarmac," with the exception of about ½ mile of ordinary metal near Dunchurch, which, we noticed, had recently been patched with "Tarmac" and tar-painted. The traffic is very similar to the road west of Coventry, but, perhaps, not so heavy; en route we passed through the old village of Dunchurch, which is well worth a visit.

The Tarmac Works, Ettingshall, Wolverhampton.

The Warwickshire scheme includes, besides the work we inspected, long stretches on the Chester road, Coventry—Leamington road, and Watling Street. The total length of main roads included in the scheme approximates to no less than 50 miles. The cost of the work was estimated to amount to £76,450.

The method employed is to strengthen the old road

surface with slag, or other suitable material, where required and provide a surface coat of "Tarmac." 3 in. consolidated thickness, with the exception of the Coventry—Birmingham road, which, on account of the extra traffic, is being laid with a 4-in. consolidated coat of "Tarmac." We were informed that the chairman of the Warwickshire County Roads and Bridges Committee, Captain Oliver-Bellasis, took a

Birmingham and Coventry Road at Bickenhill, Warwickshire.

leading part in the preliminary arrangements, and takes a keen interest in the progress of the work. From what we saw, both Captain Oliver-Bellasis and Mr. Willmot are to be very heartily congratulated on the excellence and uniformity of the work produced.

In Worcestershire a commencement was made with an inspection of the Kidderminster—Worcester main road, which is subject to heavy motor-lorry, steam-lorry, and other general traffic, with a motor-'bus service. Some 7 miles of this road has been completed within the last two years, and the work presents a distinctly good appearance throughout. A trial length of "Westrumite" has been laid on this road as a top dressing or sealing coat on top of the "Tarmac," some 7 miles from Worcester, and looks well. We also inspected a length of road through the old-world village of Ombersley, which, some two years ago, was laid with ordinary macadam bound with "Ferromac." The surface has been tar-painted twice since, and looks well. This length of road, we noticed, is kerbed and channelled both sides, which adds very considerably to the general appearance of the village. "Tarmac" surfacing is in progress on this road near the Kidderminster borough boundary.

The next road through which our journey took us was the Worcester—Droitwich and Birmingham main road, which is finished from Worcester to Bromsgrove—a splendid stretch of road some 12 miles in length; uniform in lay-out, crossfall and surface, it is an ideal road for modern use. The road is very largely used by through traffic between Birmingham and Malvern, and the great improvement is generally appreciated and widely known.

Commencing at the Worcester city boundary, Mr. Gettings laid a series of test lengths of various forms of bituminous construction some two years ago, and in the paper which he read at the annual meeting of the Institution of Municipal and County Engineers last week his observations upon them are well worth perusal, and contain much valuable information. We took the opportunity to examine them closely, and were very favourably impressed by the condition of the lengths of "Tarmac" and tarred slag

Coventry and London Road, near Willoughby, Warwickshire.

From Bromsgrove we took our way across to the Birmingham—Stourbridge road, upon which some 4 miles is now complete, passing on into the crowded manufacturing district between Birmingham and Stourbridge. It was quickly apparent that we had reached a heavily trafficked road. Mr. Gettings informed us that it is, in point of fact, one of the heaviest trafficked roads in the Birmingham district, subject

to constant motor-'bus traffic, heavy engine and lorry and manufacturing traffic generally, a recent census revealing the average daily load of, approximately, 2,000 tons per day. If any proof were required in these later days of the ability of tarred slag to withstand the strain of heavy traffic, it is forthcoming in an inspection of the "Tarmac" on this road at Quinton.

We can only say of Worcestershire road making what we have said of Warwickshire—excellent, very

Birmingham and Warwick Road, Coptheath, Warwickshire

excellent work is shown for the money spent. Mr. E. J. Bigwood, the chairman of the County Highways and Bridges Committee, has taken a very active interest in the work, and Mr. Bigwood and the county surveyor are to be very heartily congratulated. The scheme in Worcestershire involves the reconstruction of some 53 miles of main roads, including the Birmingham—Redditch, Worcester—Kidderminster, Worcester—Malvern, Worcester—Droitwich and Birmingham, Birmingham—Stourbridge, and Worcester—Bristol roads, at a total estimated cost of £127,000, towards which very substantial assistance is being given by the Road Board.

In conversation with Mr. Gettings, we discovered him to be a firm believer in an adequate foundation. His scheme provides generally for strengthening the sides of the roads, and providing a good substantial slag foundation. His contention is that it is useless to spend good money on up-to-date surface materials without providing good foundations to carry them. Mr. Gettings lays "Tarmac" to an average consolidated thickness of 3½ in., his method of laying being slightly different to that usually employed. We can only say that the results justify the method.

In both counties the wise provision is made of periodically dressing the road surfaces with approved refined tar and chippings.

We took the opportunity of renewing our acquaintance with the "Tarmac" works while in the district, and the manager and secretary of the company, Mr. D. G. Comyn, showed us round, and gave us some interesting particulars of extensions carried out and in progress. The works are known to many of our readers, visits of engineers having been paid on the occasion of the annual meeting of the Institution of Municipal and County Engineers at West Bromwich, and the International Road Congress in 1913. One cannot help being struck by the enormous strides which have been made during the past two years; the works have been doubled, and we were informed that over £40,000 is laid out in capital expenditure at these works alone. The company's works at Denby have also been largely extended. The company are owners of no fewer than 1,350 railway wagons, which

Birmingham and Stratford Road, Shirley Village, Warwickshire.

conveys some idea of the tonnage dealt with. Mr. Comyn informed us that arrangements have been completed with the Brymbo Steel Company, Limited, near Wrexham, for the erection and equipment of works to make "Tarmac" from the slag at the Brymbo furnaces; the new works at Middlesbrough would have been completed some time ago had not the war unfortunately intervened. In consequence of this, however, it is anticipated that they will not be

finished before the beginning of next year. Incidentally Mr. Comyn informed us that he has just completed a trial stretch of "Tarmac" for Mr. Moncur, the Staffordshire county surveyor, on the main Walsall—Birmingham road, and has made arrangements for two other trial lengths in the county; also

BIRMINGHAM AND WORCESTER ROAD AT WALCHEOLD WORCESTERSHIRE.

that the firm recently secured a contract with the War Office for military roads for some thousands of tons.

Our thanks for courtesy and information are due to Mr. Willmot, Mr. Gettings and Mr. Comyn; it was a most interesting and instructive tour of inspection.

Admission of Liquid Trade Wastes into Sewers.—Mr. Reginald Brown, engineer and surveyor to the Southall-Norwood Urban District Council, writes: I am collecting information on the following points: Name of town; Population; Dry-weather flow in gallons per day; What percentage of flow is due to liquid trade wastes; Is system combined or separate? Nature of wastes and their proportions; Are manufacturers required to carry out any preliminary treatment? If so, what? Is any special payment made to the local authority by manufacturers? If so, what? and basis of payment; Any regulations as to periods for discharging trade liquors; How is sewage treated at the sewage works? Does the trade liquor interfere with the purification of your sewage? Remarks. I appeal through your columns to those of my colleagues who have any information on the question to supply me with it. Regulations for the admission of trade wastes into sewers will be particularly acceptable.

RESURFACING OF MAIN ROADS IN TAR, PITCH, AND BITUMINOUS MACADAM.*

BY PERCY J. SHELDON, M.INST.C.E.,
County Surveyor, and
ALFRED J. LYDDON, ASSOC.M.INST.C.E.,
Deputy County Surveyor of Essex.

In this paper the authors describe works which are being executed in connection with a main road reconstruction scheme of 140 miles, spread over a period of five years, which has been arranged between the county of Essex and the Road Board, the estimated expenditure being over £500,000. The work has now been in progress nearly twelve months, but in consequence of the war progress has been considerably retarded. The scheme provides for resurfacing over 2,000,000 sq. yds. of road; of this total the following areas of tarred and bituminous macadam are included: Tarred slag, 174,550 sq. yds.; bituminous macadam, 428,741 sq. yds.; the remainder comprising

BIRMINGHAM AND STOURBRIDGE ROAD AT QUINTON, WORCESTERSHIRE.

granite setts, wood blocks, and water-bound resurfacing with which the notes are not concerned.

The various kinds of materials used up to the present are classified as follows:—

1. Mixtures composed of tar and pitch and mineral aggregate.

* Extracts from paper read at the opening sitting of the National Road Conference on Monday.

(*a*) Tarred slag (proprietary material).
(*b*) Tarred slag mixed and laid from mixing machines on or near the road.

2. Bituminous macadam composed of mineral aggregate and a binder of—
(*a*) Trinidad asphalt.
(*b*) Residuals produced by distillation of asphaltic and other oils.

Tarmac on Test, near Borough Boundary, Worcester.

( ) Combination of (*a*) and (*b*) sold as proprietary articles.

GENERAL CONCLUSIONS.

Having described some of the works carried out in bituminous material, the authors set out some of the salient points of interest on which it is considered further information is desired before more extended use can be made of the class of paving referred to as bituminous.

THE EFFECT OF VARIOUS KINDS OF SOIL ON BITUMINOUS MATERIAL UNDER KNOWN CONDITIONS OF TRAFFIC.

The observations made by the authors in carrying out the work referred to in Essex lead them to the conclusion that this material should not be laid where clay will come into direct contact with it.

It has been noted where water-bound crusts have been thin, and where clay underlies it at the sides of the road, that the underside of the bituminous macadam is more or less in a moist condition at all times, and this causes serious local disintegration by a general softening of the material, which is soon broken up by the traffic.

It has been found necessary to cut out several patches which have been so affected.

Although not coming under this head, the detrimental effects of oil, &c., dropped by mechanical vehicles is a matter for attention and consideration, particularly soon after the material has been laid.

THE DESIRABILITY OF A STRONG FOUNDATION WHERE THE CHARACTER OF THE ROAD JUSTIFIES THE USE OF A BITUMINOUS PAVING.

The necessity for a good strong sub-crust on which the material is laid cannot be too greatly emphasised.

The authors consider that several cases have been recorded in which failures have been attributed to the paving material, whereas investigation has indicated that the non-success was due to a weak sub-crust.

Many contractors who are responsible for laying this class of material are prone to overlook this *sine qua non*, with often lamentable results after such a winter as 1914-15.

Birmingham and Worcester Road.
(Five miles from Worcester).

THE SUITABILITY OR OTHERWISE OF OPEN MIXTURE (OR BITUMINOUS CONCRETES) FOR USE AS WEARING SURFACES IN DAMP SITUATIONS.

The observations made under this head have been with the class of binders numbered 2 (*b*) in these notes—viz., residuals—and with this material the authors have concluded that the use of large percentages of stone in the mixtures is precluded in this country

owing to the long periods, sometimes extending over three to four months, when the material is rarely if ever dry, and in which condition the water appears to attack the binder to such an extent as to cause disintegration of the surface.

The destruction of the stone on the surface of the material by steel-tyred vehicles has also a considerable effect on its wearing qualities.

The authors are unable to advance a definite opinion as to the relative water resistant proportions of the mixtures containing various percentages of mineral aggregate and bitumen, but their experience indicates that mixtures made with the same bituminous binder, those which are densest appear to be least affected by water action.

THE NECESSITY FOR SUITABLE AND RELIABLE TESTS FOR ASPHALT CEMENTS.

One of the difficulties with which the user of this class of material is confronted is the lack of uniformity of the bituminous binder or asphalt cement.

The authors refer more particularly to the residual class of binder which needs the use of a fluxing oil.

The test for uniformity used up to the present—viz., the penetration test—leaves much to be desired.

The substitution of a needle square in section for the pointed needle, making the test similar to that of the Faija needle for cement testing, would appear to simplify the use of the penetrometer and make the penetration test more reliable than at present obtains.

THE DESIRABILITY OF MAKING TESTS AND ANALYSES OF BITUMINOUS MATERIALS UNDER KNOWN CONDITIONS OF USE.

The systematic recording of tests and analyses enables a basis for comparison to be established which under known conditions of traffic cannot fail to be of service for the future selection of paving, particularly if records are kept of the condition of the paving at regular intervals in its life.

In carrying out most of the work referred to herein the authors have considered it advisable to have records made of every variation in the composition of the material laid on the road.

In each case daily samples of binder, mineral aggregate and finished material are taken and sent to the head office for analysis and record.

The man in charge of the plant or the clerk of works supervising the contractor's work checks the weighing of the batches of materials as they are prepared prior to mixing.

The analysis of the finished material affords some check on the man in charge of the plant both as regards percentage of binder as well as mineral aggregate.

THE ALLOWABLE LIMITS OF PERCENTAGES OF BITUMEN IN MIXTURES CONTAINING VARIOUS MINERAL AGGREGATES.

The correct percentage of bitumen with a given aggregate does not appear to be a matter on which much information exists.

Speaking generally, the smaller the particles of the mineral aggregate the larger the percentage of bitumen carried by the mixture without making it difficult to manipulate on the road.

Data appear to be necessary to establish the maximum percentage of bitumen which a mineral aggregate having particles of known grade will hold without the mixture becoming saturated with bitumen, and conversely the minimum percentage necessary to withstand water action and other disintegrating agents.

At the present time the method of arriving at the percentage of bitumen appears to vary considerably, and its application leaves much to be desired.

THE CAUSE AND PREVENTION OF CORRUGATIONS.

Corrugations appear to be of two kinds—(*a*) those formed during the consolidation of the material by the roller; and (*b*) those formed by the traffic under temperature variations.

(*a*) Corrugations Formed During Consolidation.—It is possible that many if not all waves in the road surface emanate from this source. The authors have had occasion to give much consideration to the formation of waves during the rolling of material formed with tarred and residual binders, and it appears to be established that the temperature of the material when rolled plays a not inconsiderable part in the formation of corrugations. In one case rolling has been executed with 5-ton rollers, the temperature of the material being as high as 300 to 350 deg. Fahr., on a course of 12 in. in thickness with the result that it became impossible to avoid corrugations at intervals of 3 ft. to 4 ft. In another case rolling was carried out at a temperature of about 200 deg. Fahr.; the material being hand rolled in a transverse direction previously, the effect on the surface was almost to avoid the formation of corrugations. The constitution of the mixture appears to play some part in the formation of corrugations. At a constant temperature a dense mixture will tend to corrugate sooner than one less dense. Corrugations appear less on mixtures laid in thin layers. Rich mixtures, containing comparatively high percentages of bitumen, should not be laid in layers of greater thickness than 1 in. to 1½ in. to reduce corrugations to the minimum.

(*b*) Corrugations Formed by Traffic Under Temperature Variations.—The ability of traffic to form corrugations appears to depend in a measure on the variations of temperature to which the road is subjected under varying climatic conditions. Corrugations have been noted where none previously existed in a 1-in. carpet laid on a water-bound surface during a spell of hot weather, when a surface temperature was recorded of 130 deg. Fahr. On a gradient of 1 in 20 the waves proved so great on the down side as to necessitate relaying. Speaking generally, all mechanically propelled vehicles appear to exert some influence in the form of waves, but the nature of the foundation of the road is a factor of importance, a yielding foundation, other elements being equal, conducing to the production of corrugations.

THE BRITISH FIRE PREVENTION COMMITTEE.

Replying to questions in the House of Commons on Monday Sir J. Simon, the Home Secretary, said the British Fire Prevention Committee was an unofficial organisation, the objects of which, he understood, were to circulate information and suggestions and generally to further the adoption of scientific and practical means for prevention of fire. It was not in any way under the control of the Home Office, but it was within the knowledge of the department that the committee had done and was doing a considerable amount of useful work. In answer to further questions, Sir J. Simon said he had seen the circular issued by the committee giving instructions as to dealing with fires due to air raids, and containing illustrations and descriptions of incendiary bombs. It contained what he believed to be useful suggestions for dealing with fires arising from incendiary bombs, but in view of the warning already issued by the Commissioner of Police he did not think the distribution of copies to London householders—proposed by the questioner—was necessary. It was not desirable to multiply warnings on the same subject.

Bradford Town Planning Competition.—The premiated designs in the recent competition for the treatment of streets in the central area of Bradford will be exhibited in the galleries of the Royal Institute of British Architects for a fortnight, commencing on Monday, July 5th, between the hours of 10 a.m. and 6 p.m. Admission will be free.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

Heating and Ventilating Engineering.—Two heating scholarships, tenable in the Faculty of Engineering of University College, London, each of the value of £50 a year, together with £11 11s., being the amount of college fees, may be awarded in July by the Institution of Heating and Ventilating Engineering. Candidates must produce evidence that they have already pursued a course of engineering training, and are familiar with the work of an engineering laboratory. The research students will be required to devote their whole time to research work in connection with heating and ventilating engineering. Full particulars can be obtained from the secretary of University College, London, to whom application must be made not later than Wednesday, July 7, 1915.

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law. A.M.I.C.E., &c. London: St. Bride's Press, Limited. Price 10s. 6d.

"DETAILS" FROM THE DARDANELLES.

The following extracts from letters received from the director of a British granite concern, well known in connection with Belgian quarries, who is now serving with the Royal Naval Division Engineers at the Dardanelles, will, we think, be of special interest to our readers as showing the brave and cheerful spirit in which they are written, and the splendid sense of humour of the writer.

The first letter, written on April 27th, says, after a'l :—

"We have been on board ship again for the last three weeks—not the boat we were on before, but one called the . We have a lot of horses and mules on board with us, and, although we don't exactly have our meals with them, still we see a lot of each other. The horses are taken for a walk round the deck every day, and altogether it is a job to get out of their way. This boat used to be a meat ship, and we live in one of the refrigerator holds, but they have very considerately turned the cold circulation off. We notice the contrast now with the ——, which was an exceptionally clean boat; this, of course, is not. Am spending most of my time flag-wagging—that and grinding oats and scrubbing tables are about the only pastimes we have. We are getting very fed up with hanging about, and are looking forward to getting on the move."

The next letter, written four days later, contains the following :—

"We have been having quite an exciting time since I last wrote you. I still mustn't tell you where we are, so you will have to try and guess that. From the time of my last letter up till last Tuesday we hung about in harbour, doing nothing special and getting very fed up about it. Didn't even go ashore at all this time, so you can imagine we got pretty sick of this dirty old boat. Then on Tuesday afternoon we received sudden orders to leave, so we came out in a hurry, about five hours' journey, and rejoined a big fleet of transports lying a few miles off the shore. It was a sight worth remembering. There were battleships, cruisers, and destroyers all over the shop, and the big gun bombardment was going on pretty steadily that evening. We could hear the firing 50 miles or so away before we came along here, so you can imagine we can hear it pretty distinctly now! As far as we could see there were no answering shots. We dodged about until Thursday, and then at dusk we went ashore. We had to carry all our kit, blanket, &c., and two days' rations, and I can tell you I felt like a loaded pantechnicon. There was no opposition in landing, as the enemy had been driven some way inland, and the cliffs protected us from all but a few stray bullets, and you soon get quite used to the hum of them. Our landing place was a regular little town crowded with stores and stuff. It rather reminded me of St. Margarets Bay—a little semi-circular bay with a beach and steep cliffs covered with bushes. We bivouacked on the beach that night, digging ourselves in a couple of feet to keep off stray bullets and shrapnel. We had a fair dose of shrapnel that night, although I was asleep, and missed seeing it. Next morning we went up a valley to a place just behind the firing-line, and proceeded to dig ourselves in again. I had made, with another chap, quite a nice little place that I was thinking of calling ——, but as it happened we didn't stay there—we spent that afternoon making a road for guns up part of the cliff. We were just nicely under cover there, and could hear the bullets humming by safely overhead. There was occasional shrapnel overhead too, and then our artillery and naval guns would reply with a terrific boom and a whirr like a distant train as the shell passed over our heads. It was decidedly cheerful to recollect that the naval guns were ours and not the enemy's. We finished our road in record time, and were congratulated on it—several hundred yards of 10-ft. wide road cut out of the cliff-side in about six hours, a record which I don't think any of our surveyor friends can beat. Then after dark we got sudden orders to re-embark, as we were apparently wanted elsewhere, so we only had twenty-four hours ashore, and are now on board again."

The next letter is dated May 16th, with the rather pathetic statement, "Sunday, I believe," and is as follows :—

"Am sitting writing this in my 'diggings' in 'camp,' being blessed with a morning off after three days in the firing-line. I have an elegant little apartment, constructed of earth and some extremely skilful masonry, the material for which I have pinched from a neighbouring dug-out, whose former owner probably pinched it from the relics of some house that may have existed here. It is 7 ft. long, and cut out to about 3 ft. high at the top end, so that I can sit in it comfortably, while at the same time keeping myself more or less below ground. It happens to be a glorious day—it usually is here—and I have a splendid view out over the valley with the water about a mile away. Sounds like a villa residence advertisement—doesn't it? We are some distance back from the front here, and usually return here to sleep. The latter is quite a luxurious proceeding here—I even take my boots off!—the only disadvantage being when the ground suddenly gets up in the middle of the night and hits you a bang over the ear—this happens whenever they fire one of the guns on the top of the hill. However, one gets used to that. Have had quite an interesting three days away up in front with a little party of five on our own—showing some infantry how to improve their trenches, &c. Things were very quiet, and we had no excitement, except that they used to wake us up every half hour or so during the night and shout 'Fix bayonets' and 'Enemy advancing on the left,' and 'Where's that —— sentry?" and things like that, just to keep things going. But, being engineers, we didn't take any notice. In fact, the only real excitement was when we made a pudding one day. I volunteered for eating some, and came out of the engagement quite well. The recipe is as follows: Take four or five biscuits and attack them firmly and persistently with one or both ends of a pickaxe until their resistance is completely overcome. Place in a billy can, add water or liquid mud (whichever happens to be fashionable in your locality), and allow to simmer over a brushwood fire. To light the latter it is advisable to borrow a match, owing to the scarcity of these articles. When reduced to a pulpy consistency, add a large quantity of sugar and half a tin of jam—either apple and plum or plum and apple, whichever it happens to be called. Dish out sharp, and serve hot. It is to be distinctly understood that the inventors take no responsibility whatever, and that the transaction is at company's risk. I have had a shave this morning—first since I landed—and there is a chance of a bathe later on!—so am feeling quite pleased with myself."

The last letter, written a short time ago, contains the following :—

"The weather continues fine, but I am afraid there is no immediate prospect of an increased demand for ice—unless the Italians come out here and bring their ice-cream barrows with them. I vish they vould. Little drops of water, little grains of sand—either *au naturel* or coloured with tea—form our only beverage, barring a mouthful or less of rum every two days and some occasional slime-juice. We have made and are making some miles of road, but I fear it is not going to be kerbed just yet. With us business is decidedly brisk. There are next to no enquiries, but plenty of orders—rather too many in fact. Labour is extremely troublesome—when you have to do it yourself. The Turks don't seem to appreciate the fact that we are improving their country for them, and insist on trying to behave in a most silly and irritating fashion. I suppose they are afraid that the rates will go up. I should rather like to meet the former local surveyor—with ten rounds in the magazine and one in the breech—and see if I can't get him to promise us some orders when the war is over."

These letters all have such a "true" ring about them, and bring home to those of us who are obliged by disability to remain at home the hardships that our brave defenders have to put up with, and the splendid manly spirit with which they are fighting for our comfort. We hope that we may be permitted to publish some more extracts at a future date.

A Brighton Meeting.—The Royal Sanitary Institute announce that arrangements are being made for a meeting at Brighton on September 3rd and 4th, at which discussions will take place on Indian sanitation, the sanitation of camps, and the Final Report of the Royal Commission on Sewage Disposal. There will be visits in the afternoons to the Indian hospitals and municipal undertakings.

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

ANNUAL SUMMER CONFERENCE.

The annual summer conference of the Association of Managers of Sewage Disposal Works will be held at Leeds on Saturday, July 10th.

PROGRAMME.

10.45 a.m.—Assemble in the council chamber.

The Lord Mayor (Mr. E. Bedford) will welcome the association.

Dr. H. Maclean Wilson, M.D., B.SC., will deliver his presidential address.

Mr. Geo. A. Hart, M.INST.C.E., sewerage engineer to the city of Leeds, will explain the works of the main drainage and sewage disposal scheme.

Mr. John T. Thompson, chemist and acting manager of the works, will read a paper, "Seven Years' Experience with a Large Sludge-pressing Plant."

Discussion.

1 p.m.—Luncheon at Victoria Hotel (2s. per head).

2 p.m.—Char-à-banc will leave for the outfall works (about 2s. per head).

2.30 p.m.—The visitors will be conducted over the works by Mr. Geo. A. Hart, M.INST.C.E., and staff.

4.30 p.m.—Char-à-banc will leave works for Leeds Town Hall.

5 p.m.—Afternoon tea will be served in the Lord Mayor's rooms of the town hall, at the invitation of the Lord Mayor.

J. B. CROLL,
Secretary.

ROYAL SANITARY INSTITUTE.

YEOVIL MEETING.

At Yeovil, on July 14th, a discussion on "Water Supplies to Rural and Small Urban Areas" will be opened by Dr. W. G. Savage, county medical officer of health of Somerset.

The proceedings will open at the town hall at 11.15 a.m., and will be presided over by Sir Henry Tanner, chairman of the council of the institute.

Coast Sand Dunes, Sand Spits, and Sand Wastes. (By G. O. Case. Price 5s. St. Bride's Press, Limited, 24 Bride-lane, E.C.). . . . "A most useful little book crammed with facts culled from all parts of the world and well illustrated with photographic reproductions and diagrams. Numerous references to other works are given. Mr. Case discusses the formation and distribution of sand dunes and the devastation caused by them when they move inland, and then goes on to consider protective works and the reclamation of sand wastes. If we have one criticism to offer it is that the book is too condensed. There is certainly not a superfluous paragraph."—*Geographical Journal.*

Sewage Disposal at East Retford.—The sewage works of the East Retford Town Council were visited recently by the members of the Yorkshire District of the Association of Managers of Sewage Disposal Works. Describing the undertaking, Mr. J. D. Kennedy, the borough surveyor, mentioned that the population of the borough is about 11,000, and the rateable value £58,500. The sewage of the town, with a limited quantity of surface water, gravitates to ejectors at Bolham, where it is lifted a height of 60 ft. to the disposal works by means of Shone's ejectors. The site comprises 32 acres of light, dry land, unique for filtering effluent water. The buildings are substantial, and comprise an engine-house, boiler-house, press-house, coal store, workshop, and workmen's room, chemical-houses, office, and three precipitation tanks, each holding 100,000 gallons. The machinery comprises a pair of horizontal compound high-speed steam air compressors, capable of raising a pressure of 35 lb. per square inch, for working ejectors; one horizontal steam engine air-compressing intensifier, capable of raising the pressure to 100 lb. per square inch for pressing sludge; two Galloway boilers working at a pressure of 80 lb. per square inch; and a sludge-pressing plant. The method employed for the treatment of the sewage is precipitation and land filtration. The sewage is principally domestic.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

INSPECTOR OF NUISANCES.—July 5th.—Penzance Town Council. £110—£145 per annum.—Mr. T. H. Cornish, town clerk, 8 Parade-street.

SURVEYOR.—July 5th.—Axminster Urban District Council.—Mr. C. Forward, clerk, Council Offices.

SUPERINTENDENT OF FIRE BRIGADE.—July 5th.—Corporation of East Ham. £150 per annum, with house, fuel, lighting, and uniform.—Mr. C. Eustace Wilson, town clerk.

SURVEYOR AND INSPECTOR.—July 9th.—Street Urban District Council. £175 per annum.—Mr. S. T. Clothier, clerk.

SURVEYOR AND SANITARY INSPECTOR.—July 10th.—Brumby and Frodingham Urban District Council.—Mr. G. S. Sowter, solicitor and clerk, Brigg, Lincs.

DEPUTY MANAGER.—July 12th.—The Maldens and Coombe Urban District Council. 30s.—35s. per week.—The Clerk, Council Offices, New Malden, Surrey.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

WEST RIDING.—July 3rd.—For repairs to schools, for the Education Committee.—Mr. A. Angus, West Riding Education Offices, Wakefield.

ELY.—July 5th.—For the building of an isolation hospital, for the urban and rural district council.—Mr. S. J. Wearing, architect, 15 Upper King-street, Norwich.

MANSFIELD.—July 5th.—For arching over a river and incidental works, for the corporation.—Mr. W. Thompson, borough engineer and surveyor.

KENT.—July 5th.—For repairs to schools, for the Education Committee.—Mr. W. H. Robinson, architect, Sessions House, Maidstone.

WOOD GREEN.—July 6th.—For repairs to certain schools, for the Education Committee.—Mr. W. P. Harding, clerk, Town Hall.

BELFAST.—July 6th.—For the erection of a new principal in roof of Ulster Hall, for the corporation.—City Surveyor.

SHEFFIELD.—July 6th.—For the erection of a substation, for the Electric Supply Committee.—Offices, Commercial-street, Sheffield.

GOOLE.—July 7th.—For the erection of a shelter and convenience, for the urban district council.—Mr. J. H. Castle, engineer and surveyor.

BEDS.—July 7th.—For renovation works at various schools, for the Education Committee.—Mr. R. K. Ellison, Shire Hall, Bedford.

BURY.—July 7th.—For the erection of a sanatorium, for the District Joint Hospital Committee.—Mr. F. Wild, clerk, Cross-street, Bury.

WREXHAM.—July 8th.—For redecorating and painting certain buildings, for the corporation.—Mr. J. England, borough engineer, Willow-road.

BISHOP'S STORTFORD.—July 9th.—For a nurses' house and laundry at hospital, for the Joint Committee.—Mr. A. G. Gwynn, clerk, 29 North-street, Bishop's Stortford.

HEBDEN BRIDGE.—July 10th.—For painting and repairs to schools, for the District Education Committee.—Mr. F. J. Macdonald, Education Offices, Sowerby Bridge.

WAKEFIELD.—July 12th.—For the erection of brick boundary wall, for the corporation.—City Surveyor.

SUNDERLAND.—July 15th.—For the erection of hospital blocks and alterations to laundry and gate-house, for the corporation.—Borough Surveyor.

Engineering: Iron and Steel.

DUNDALK.—July 5th. For sinking a well and erecting a pump for the rural district council. Mr. Cahil, Council Offices.

HUDDERSFIELD.—July 5th.—For heating engineers' work in connection with new sectional boilers, for the corporation.—Town Clerk.

ERITH.—July 5th—19th.—For the supply of electricity plant, for the urban district council.—Engineer and Manager, Electricity Works, Walnut Tree-road, Erith.

WITHERNSEA.—July 6th.—For the supply and laying of water mains, for the urban district council.—Mr. J. B. Kirton, engineer, Council Offices.

MERTON.—July 12th.—For pumping a pump for the urban district council.—The Sanitary Inspector.

MADRAS.—July 14th.—For the supply of cast-iron pipes, special castings, sluice valves and hydrants, for the corporation.—Mr. J. W. Madeley, special engineer; agents, Messrs. James Mansergh & Sons, 5 Victoria-street, Westminster, London, S.W.

MERTHYR.—July 26th.—For the supply of steel and cast-iron pipes, and for laying 3½ miles of pipe lines, for the corporation.—Sir Alex. Binnie, Son & Deacon, St. Stephen's House, Victoria Embankment, S.W.

RANGOON.—August 11th.—For the installation of a system of fire alarms, for the municipality.—Messrs. Ogilvy, Gillanders & Co., 67 Cornhill, London, E.C.

Gas and Electricity.

ERITH.—July 5th—19th.—For the supply of one water-tube boiler, with superheater, and one 2,000-kw. high-pressure turbo-alternator, for the urban district council.—Engineer and Manager, Walnut Tree-road, Erith.

EDINBURGH.—July 12th.—For one 1,000-kw. motor converter and transformer, for the corporation.—The Engineer, Dewar-place, Edinburgh.

Roads.

HARROW.—July 3rd.—For the supply of broken granite, gravel, tarred granite or slag, and tarred granite or slag chippings, for the urban district council.—Mr. J. P. Bennetts, surveyor.

SHEFFIELD.—July 3rd.—For laying about 1,900 yards of creosoted wood paving, the price to include seven years' free maintenance, for the corporation.—Mr. W. J. Hadfield, city surveyor, Town Hall.

HUYTON.—July 3rd.—For paving work with granite setts, for the urban district council.—The Surveyor.

WELLINGBOROUGH.—July 3rd.—For the supply of granite, granite treated with Bi-tarco, limestone, limestone chippings, and patent paving slabs, for the urban district council.—Mr. J. T. Parker, clerk, 20 Church-street, Wellingborough.

COTTINGHAM.—July 5th.—For the supply of broken whinstone, granite, and screened chippings, for the urban district council.—Mr. J. H. Hanson, surveyor.

COALVILLE.—July 5th.—For making up and sewering part of a street, for the urban district council.—Mr. L. L. Baldwin, surveyor.

WHICKHAM.—July 5th.—For the supply of whinstone, limestone, and slag, for the urban district council.—The Surveyor.

ROMFORD.—July 5th.—For a street improvement, for the rural district council.—Mr. W. J. Grant, surveyor.

CRAMLINGTON.—July 6th.—For making up a back street, for the urban district council.—Mr. W. J. Coulson, surveyor.

LLANDUDNO.—July 7th.—For works of road improvement, for the urban district council.—Engineer and Surveyor, Town Hall.

HALE.—July 7th.—For making up back passages, for the urban district council.—Mr. T. Blagburn, surveyor.

PONTEFRACT.—July 7th.—For team labour and the erection of creosoted wood fencing, for the rural district council.—Mr. J. P. Senior, surveyor.

BEDS.—July 7th.—For work of tar-painting and repairing, for the Education Committee.—Mr. R. K. Ellison, surveyor, Shire Hall, Bedford.

HASTINGS.—July 9th.—For steam rolling work, for the rural district council.—Mr. J. Standen, district surveyor, Ivy House-lane, Ore, Hastings.

LEES.—July 10th.—For work of asphalting, for the urban district council.—The Surveyor, Council Offices, Cross-street, Lees, Lancs.

CASTLE DONINGTON.—July 10th.—For the supply of broken granite and slag, for the rural district council.—The Surveyor.

BUNGAY.—July 14th.—For the supply of Mountsorrel granite, for the urban district council.—Mr. E. Earl, surveyor.

DURHAM.—July 19th.—For excavating, providing and laying reinforced-concrete foundations, and paving with granite setts on certain sections of main roads, for the county council. Mr. Albert E. Brookes, county engineer and surveyor, Shire Hall, Durham.

TUNBRIDGE WELLS.—July 20th.—For the supply of 1,100 tons of granite or hard limestone chippings for road tarring, ⅝-in. to ¾-in. gauge, for the corporation.—Mr. W. H. Maxwell, borough engineer.

SCUNTHORPE.—July 26th.—For the supply of any quantity up to 400 tons of broken granite of approved quality, for the urban district council.—Mr. Herbert Heap, engineer and surveyor.

Sanitary.

NEWPORT (I.W.).—July 5th.—For the removal of house and road refuse, for the corporation.—Mr. T. Ross Pratt, town clerk.

HORNCASTLE.—July 5th.—For the construction of a sewer, manhole and gully, for the rural district council.

LANCHESTER.—July 5th.—For cleansing privies and ashpits, for the rural district council.—Mr. J. R. Lupton, surveyor.

WREXHAM.—July 7th.—For the removal of house refuse, for the rural district council.—Mr. G. V. Price, interim clerk, Council Offices.

ECCLES.—July 7th.—For supplying and fixing sanitary fittings, for the Education Committee.—Mr. J. Knight, architect, 5 Cross-street, Manchester.

GOOLE.—July 7th.—For nightsoil scavenging, for the urban district council.—Mr. W. H. Ellis, sanitary inspector.

VENTNOR.—July 7th.—For the collection and disposal of house refuse, for the urban district council.—Mr. H. H. Oakes, clerk, Town Hall.

ROYTON.—July 12th.—For the construction of a 12-in. pipe sewer, for the urban district council.—The Surveyor.

SMALLBURGH.—July 15th.—For work of scavenging, for the rural district council.—Mr. F. Davies, clerk, North Walsham.

ETON.—July 19th.—For scavenging work, for the rural district council.—Mr. C. P. Summerhayes, Fairview Villas, Colnbrook.

HOWDEN.—For laying sewer and manholes, for the rural district council.—Mr. T. Dinsdale, Hailgate, Howden.

BILLERICAY.—For the collection of house refuse, for the rural district council.—Mr. S. J. Shelley, James-on-road, South Weald.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.
‡ Provisionally accepted.

ROTHWELL.—For the construction of stoneware and cast-iron pipe collecting drain, with junctions, manholes and washouts, for the urban district council.—Messrs. Everard, Son & Pick, Leicester:—

Williams & Co., Ipswich	£1,360
J. J. Shaddlow, Leicester	1,220
G. Lewis, Rothwell	1,198
C. Chamberlain, Leicester	1,192
A. E. Palmer, Oldfield	1,187
H. H. Barry, Radcliffe-on-Trent	1,140
W. G. Wilmott, Rushden	1,080
W. Wright, Chesham	1,069

TIPPERARY.—For the supply of four 6-ton end tipping wagons, for the county council. County Surveyor:—
Fleming & Co., Glasgow, £75 each.

WANDSWORTH.—For surface drainage at Putney Vale Cemetery, for the borough Council.—Mr. P. Dodd, borough Engineer:—
L. & E. Iles, £277.

WANDSWORTH.—For making up Bracken-avenue, Putney, for the borough council:—
T. Adams, £1,517, and 10 per cent above schedule prices for extras or omissions.

The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

Municipal Engineering War-time Appointments.

We draw attention to further correspondence which appears on another page of this issue. There appears to be no lack of suitable applicants for these appointments, and we again appeal to local authorities to let us know their requirements. Engineering officials could assist by bringing our scheme under the notice of such authorities as might be able to make use of it.

*

Mechanical Haulage.

The three papers dealing with the use of mechanically propelled vehicles for municipal purposes, presented at the recent annual meeting of the Institution of Municipal and County Engineers and reproduced in our issue of last week, deal very fully with the various types of vehicles in use for town or country work. These vehicles are used for an ever-increasing number of purposes—road haulage, watering, tarring, sweeping, the collection of road sweepings and refuse, not to mention tramways and omnibuses, are all now carried out by mechanical traction. The power for the motor varies according to the geographical and economic factors operating in the locality where the vehicle is to work. Steam, petrol or electric driven vehicles cannot, or should not, be chosen without considering carefully the various factors which make for successful and economic working. Where coal is cheap, so far as running costs are concerned, neither petrol nor electric driven vehicles are likely to be so satisfactory or economical as steam-driven vehicles. In a hilly district the petrol-driven vehicle is generally more satisfactory than any electrically-propelled vehicle. The reserve of power which most steam engines have in being able, at a pinch, to give a greater power for a short time than the normal horse-power, is in many cases most useful, and is not possessed by either the petrol or electric motor. On the other hand, steam-driven vehicles are very objectionable in most towns on account of the noise and smoke they create. Steam wagons are rarely used with rubber tyres, but Mr. E. J. Elford in his paper advocates their use on the ground of the reduction of noise, the wear and tear of the engine, especially on stone setts—he might have added the wear of the setts themselves, which frequently have the arrises spalled off—and of the greater speed that can be obtained with rubber tyres. He also suggests that it would be an advantage to have interchangeable wheels, so that rubber tyres can be used in summer and steel tyres in winter. Many motor-driven vehicles are convertible from one class of work to another; and at Southend Mr. Elford uses a motor-driven 1,000-gallon watering van of rectangular form, which is used for watering purposes in summer and for hauling road materials in winter.

Many factors have to be taken into account in arriving at the cost of running and maintenance, and not the least important is the human factor, which, owing to careless or incompetent stoking and driving, or laziness, may make the cost vary as much as 50 per cent. During the discussion which took place it was claimed that any ordinary workman could soon be made into an efficient driver; but it will generally be found that a good fitter who can carry out his own repairs, and has a practical knowledge of the mechanism of his engine and the properties of his motive power, will not only run the vehicle more economically, but also greatly reduce the cost of maintenance. Some valuable figures of the working costs of the sixteen steam-driven vehicles owned by the Chelsea Corporation were given in Mr. T. W. E. Higgens' paper, and he was firmly convinced that they were economical, reliable and satisfactory. It must not be forgotten that the speed which Mr. Higgens finds satisfactory in the busy streets of Chelsea may not be equally satisfactory in a country district, or where long journeys have to be made. The Bedfordshire authorities prefer the petrol roller on account of the greater speed at which it can travel compared with the steam wagon—8 or 12 miles as against 5 miles—the greater convenience of using petrol instead of coal, and the smaller damage done to the roads by the rubber-tyred petrol vehicle compared with the steel-shod steam vehicle. Some valuable details of the work done and costs were given by Mr. F. W. Smart. By the use of the motor lorry the cost of haulage per ton per mile has been reduced in Bedfordshire to 3·93 pence from a cost varying from 6d. to 8d. per ton per mile for horse haulage. Incidentally this paper gives evidence of the greater cheapness of road haulage than that of railway carriage.

The value of providing storage tanks with automatic filling apparatus, the necessity for testing the quality of the petrol used, and the economy and convenience to be obtained from the local authority owning its own fleet of motor lorries, was also pointed out. In the course of the discussion the opinion was expressed that the motor vehicle was more usefully employed in street watering than in the collection of house refuse. Where it is used for conveying house refuse to the destructor, the house-to-house collection is generally done by horse-driven vehicles, and the motor wagon is loaded at convenient points. The use of a trailer was generally considered to be an advantage, but its use was accompanied by a loss of speed, as the trailer is not allowed to be driven at the speed of the motor-driven vehicle. The life of a motor vehicle is dependent upon many factors, such as the extent of its use, condition of the roads, weight of the loads carried, the care and skill of the engine driver, and the workmanship and quality of the materials employed in the construction of the vehicle itself; and therefore it is not surprising to find the life given as from seven to twenty years in different localities. The cost of petrol again varies considerably, but here again the higher priced spirit may be of such superior quality that it is much more economical than the lower priced material.

* * *

Heavy Traffic.

The papers and discussion upon this subject at the recent National Road Conference in London were exceedingly interesting and may lead to good results. There were present chairmen, aldermen, councillors and surveyors from all parts of the United Kingdom,

and the feeling of the meeting was, undoubtedly, that the question was national and not parochial. It is true that a number of speakers confined their remarks to the damage caused to our roads by self-propelled traffic, but this is evident, and it was only waste of time to emphasise it, and it had really no bearing on the two excellent papers which were under discussion. Remedies are what are required, not abuse of motor omnibuses, which, after all, are the "people's" conveyances, and are even more necessary than trams or commercial vehicles. Mr. Harcourt E. Clare, in his statesmanlike paper, and in his opening remarks, said that the best remedy for some of the difficulties which have arisen since the great revolution brought about by self-propelled traffic would be the expenditure of a large amount of money on the improvement of the roads, "in order to provide facilities by road for the quick delivery of goods, without transhipment, from the point of production to the distributor or consumer." In other words, it is essential that our roads should be brought up to date to meet present-day requirements, and that the only way to effect this is by the expenditure of money and, it might be added, brains. Mr. Clare also suggested the division of vehicles using the roads into three classes—light, medium weight, and heavy—which could then be regulated by the local authorities as to what roads they should use. This suggestion is a good one, but unfortunately local authorities also are divided into three classes—good, bad, and indifferent—and so long as human nature exists it is to be feared that leaving such a question to local authorities might end in chaos. A better suggestion by Mr. Clare, which he offered in his opening remarks, was the promotion of a Round Table Conference which should consist of road makers, road users, and manufacturers, who should call no evidence, but merely talk things over and see if some agreement could not be come to on the subject. Mr. Elford's paper dealt with the questions of weights of loads, their distribution on the axles, and other practical matters, and was of extreme interest. Unfortunately it was not well discussed, as the meeting appeared, with few exceptions, to consist of laymen who were not able to understand the points he brought forward, but his suggestions as to the constitution of a Central Government Department to deal with all road questions were very favourably received.

The impressions left on the mind after attending the conference may be stated shortly as follows:—(1) That all self-propelled heavy traffic, especially the motor omnibus, are anathema to most of the local authorities; (2) that it is unfair for a local authority to spend money on local roads which are used by "foreign" traffic; (3) that the financial arrangements and other matters connected with roads should not be left in the hands of local authorities, but in those of a central authority—preferably the Road Board—which should be given extended powers; (4) that the upkeep of roads should be a national and not a local duty; (5) that some further organisation of local authorities throughout the country is desirable; (6) that the laws relating to extraordinary traffic are practically useless and require amending, or abolishing; (7) that the recent laws relating to self-propelled traffic should be codified, amended, and enlarged; (8) that nothing in the way of further legislation can be attempted till the war is over; (9) that a number of the delegates were there for the purpose of seeing whether they could not throw the burden of payment for road construction and maintenance upon other shoulders than their own. We gather that in the view of the conference, while there are some county and other rural authorities who are alive to the fact that the roads of this country must be constructed to meet the altered conditions of traffic, there are others who are not so enlightened, and the conference argued that so long as our roads are not dealt with on a more uniform system, trouble will arise, and consequently that the sooner it is realised that the question of roads is now an Imperial one and no longer one with which the numerous local authorities can deal, the better it will be.

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Horse *v.* Motor Traction.

Motor traction has made such rapid advances in recent years that the question of mechanical haulage for municipal work has inevitably been forced to the front, and municipal engineers throughout the country now find themselves obliged to consider in regard to what services horse traction may with economy be superseded. The paper on "Horse Traction in relation to Cleansing Work" which was read last week before the Institute of Cleansing Superintendents by Mr. W. H. Hamblett, of Salford, will therefore be read with great interest. In the first place it must be recognised that no general rule can be laid down, nor can any simple answer be given to the unqualified question, Horse or motor? The problem must be faced in each district with due regard to its size, topography, and depôt accommodation; while different considerations also arise in regard to the various services for which motor traction is available. The statistics presented by Mr. Hamblett in his paper are specially valuable, inasmuch as they are based upon information received by him in answer to specific questions put to some thirty authorities in all parts of the country. The general result may be summarised by saying that mechanical traction is most favoured for the work of street watering and machine sweeping, while opinion appears to be almost equally divided in regard to the removal of house refuse and clinker.

In regard to street cleansing work there is a considerable preponderance of opinion against the use of the motor, largely due no doubt to the continual stopping and restarting which are necessary for the operation of "picking-up." In this connection it is significant that the motor appears to be favoured for those branches of work—street watering and machine sweeping—to which the non-stop principle is most applicable. It is rather surprising to find that so many localities appear to favour mechanical traction for house refuse and clinker removal. Taking into consideration the high capital cost of a motor wagon, the necessarily slow process of collection becomes a sheer extravagance, which, it would seem, can only be justified by a corresponding saving on a long distance run to a very remote depôt or tip. Even in such cases, the question of the establishment of subsidiary receiving depôts to which the material might be taken by horse vans for transfer to motors would be worthy of consideration. Enough has been said to show the interest and importance of the whole subject. For the rest, we must refer our readers to the extracts from Mr. Hamblett's paper which will be found in another column.

* * *

Reinforced Concrete.

The regulations with respect to the construction of buildings wholly or partly of reinforced concrete were again submitted to the London County Council on Tuesday. The authority to make these regulations was conferred by section 23 of the London County Council (General Powers) Act, 1909, and the original draft was before the Council so long ago as November, 1911. The regulations were prepared after consultation with the Institution of Civil Engineers, the Royal Institute of British Architects, the Surveyors Institution, the Concrete Institute, and other associations and committees interested in the matter. The regulations having been made by the Council were submitted to the Local Government Board for allowance. After prolonged negotiations with the Board a revised draft of the regulations was prepared, and the Council in June, 1913, made regulations in accordance with this draft. The amended regulations were submitted to the Board for allowance, and in accordance with the provisions of the Act the four institutions before mentioned were informed of the Council's intention to apply for the allowance of the Board. Further negotiations have taken place with the Board and

the institutions, and numerous suggestions for modifications in the regulations have been received.

In reporting to the Council on Wednesday, the Building Acts Committee acknowledge the assistance that has been derived from the co-operation of the several technical bodies referred to, and intimate that the Local Government Board has now expressed the opinion that the regulations as now amended might properly be allowed. The general effect of the final revision is that the regulations are now rather less onerous than when they were before the Council on the last occasion. Although they are legally limited in their operation to the county of London, there can be little doubt that these regulations will be taken as a model for many other areas. We note with satisfaction, therefore, not only the extreme care with which they have been prepared, but also the statement made by the Committee that if as the result of experience gained during the next few years it should be found that alterations are desirable there should be no difficulty in modifying them.

The Virtue of Cleanliness.

On the occasion of the annual meeting and conference of the Institute of Cleansing Superintendents, which opened in London on Thursday of last week, a very interesting address was delivered by Mr. D. Kennedy, of Kensington, who has been elected to the presidential chair for the ensuing year. The existence of such an organisation should be welcomed in the public interest as an evidence that those who are responsible for the control of the cleansing service in our larger towns and cities have a full realisation of the very important part which their work plays in the maintenance of the public health. It is of special importance at the present time that the work of cleansing should be maintained at a point of high efficiency, as the Local Government Board have been the first to recognise in pointing out that some limit must be placed upon the release of the ordinary working staff for the service of the Crown. In many districts this limit has already been reached, and the necessary work can only be carried on with the co-operation of householders, who should be called upon themselves to burn as much of their refuse as possible and so limit the amount to be handled and disposed of by the authorities. In this connection Mr. Kennedy quoted a circular which has been issued by the Kensington Borough Council in which it is urged that by burning all combustible refuse the householder, at the same time as he renders a public service, can effect economy in fuel, and also assist in keeping down the amount he will be called upon to pay in the general rate for this branch of the council's work. One of our statesmen has recently reminded the country that the duty of preparing for peace is no more to be neglected than that of preparing for war. In our view, this observation has a special application in the realm of public health, for in the past disease has almost invariably come as the aftermath of war. Civic cleanliness is not the least effective means by which this enemy may be forestalled; so that the work of the Institute of Cleansing Superintendents will be of more than ordinary importance in the immediate future.

Solid Tyre Rim Diameters.

Following on the recent issue of a Report on Pneumatic Tyre Rims for Automobiles, Motor Cycles and Cycles, the Engineering Standards Committee have now published a report on Solid Tyre Rim Diameters for Commercial Motor Vehicles (Report No. 71*), the work of the Sectional Committee on Automobile Parts, of which Colonel H. C. L. Holden, C.B., R.A., is chairman. The present publication amplifies the recommendation contained in the interim report on this subject which was issued in July of last year. The new report gives, in addition to the standard rim diameters, the limits within which the rims must be manufactured, and recommendations in regard to the lead to facilitate the fitting of the tyres and the number and width of the slots required for the removal of tyres if rims with raised flanges are used. The report also contains a very useful recommendation that solid tyres themselves shall be clearly marked with the width of tyre base and the diameter of the standard rim they are intended to fit.

As in the case of the pneumatic tyre rims, the pioneer work in connection with the standardisation of those for solid tyres was undertaken by the Tyre Committee of the Society of Motor Manufacturers and Traders, Ltd., under the chairmanship of Major J. Sealy Clarke. Mr. W. H. Paull, who analysed the data obtained from the various tyre and chassis makers, found that there were in use a very large and unnecessary number of wheel diameters, within the range of 30 to 42 inches, all of which more or less closely approached each other but were not interchangeable. It was ascertained from the chassis-makers that there was no real demand for a very large number of the sizes listed by tyre-makers, and by a careful process of elimination it was found practical to reduce the number of diameters to six, and at the same time cover practically all the requirements of the commercial motor industry. It is hoped that the time may not be far distant when this number can be still further reduced to four or even less, and with this object in view the committee recommend that the use of two of the six standard sizes should be dispensed with for general purposes.

Surveyors and War Work.

We have ample evidence that in their official capacity civic engineers have rendered, and are rendering, yeoman service to their country by giving freely of their professional skill and labour to assist the military authorities. It is galling to find in so many cases that the proof of this cannot be published because it comes—very properly we are bound to admit—under the veto of the censor's blue pencil, generally with the brief intimation that "this relates to the movement of troops, and as such cannot be published." We have before us, as an instance, most interesting details of a case in which a borough engineer, at practically a moment's notice, advised on and assisted with the preparation of a number of camps for some thousands of men and horses, and everything was ready in two weeks, though it included the laying of three miles of water-pipes. Graceful and well-deserved recognition of the assistance given was made to the town council by the General in command of the district, who asked that his special thanks should be conveyed to the surveyor. We hope to chronicle more fully, when the ban of the censor can happily be removed, this and many other instances of how our civic engineers did "their little bits" in the days of national stress.

Destructor By-products.

In these days, when the gospel of strict economy is being so insistently preached, a paper dealing with the utilisation of the by-products and residuals of the refuse destructor has a special interest. We make no apology therefore for devoting space this week to some copious extracts from the paper on this subject which was read last week by Mr. J. A. Priestley, the Cleansing Superintendent to the Sheffield Corporation. The principal by-products with which he dealt were fish and animal offal, which may be converted into an artificial manure, readily saleable at a profit in normal times; paper, which can be pressed into bales and re-used by the paper maker; tins and ironware, the incombustible nature of which necessitates separate treatment; and glass, which may be sold at a good price.

* Price 5s. 2d., post free, from the Secretary, Institution of Electrical Engineers, Standards Committee.

Road Engineers and Heavy Traffic.*

By ERNEST J. ELFORD, M.INST.C.E., M.I.MECH.E., Borough Engineer and Surveyor, Southend-on-Sea.

The author would first submit that the question is one which should be looked at as a business proposition, that the main consideration should be, not whether traffic of the description referred to is advantageous, damaging, beneficial or costly to local interests, but whether, and if so to what extent, it is, in the broadest sense, "good business" for the nation, either directly or indirectly.

It is generally agreed that for good or ill, and whether we like it or not, mechanical highway traffic has come to stay, and although it is possible by legislation, and by that obstructive inertia which is often one of the most useful weapons of highway and other public authorities, to retard its development and limit its scope to a serious extent, it has already acquired too much vitality to be easily killed.

As a road engineer the author has had his share of the annoyance and discouragement of seeing good macadam roads spoiled in a very short time by heavy motor traffic, and he has much sympathy with those who are burdened with the responsibility of miles of macadam roads which have in recent years become subject to this class of traffic, and who are without the funds necessary to provide suitable surfaces, and in many cases sufficient foundations, to meet the new conditions.

It is not surprising that under such circumstances many should be found who hold strong views as to the desirabilitly of applying stringent restrictions to this class of traffic. In many cases the localities upon which fall the cost of maintaining roads to carry an ever-increasing volume of such traffic reap absolutely no direct benefit, and there is grave danger that, unless the burden can be eased considerably, the feeling of resentment which arises from the existing unfair conditions may bring about results which may seriously cripple important industries and impede national progress. The effect of such a result upon national interests would no doubt far outweigh the cost of providing roads suitable and sufficient for modern traffic.

The author cannot, however, agree with those who demand that all roads should be made suitable for all traffic, as this would be extravagant and unnecessary, but in his view such roads as are reasonably necessary to enable the industries of the nation to be carried on with a high standard of efficiency should be provided. He submits, however, that the nation should find the additional funds required to provide what is necessary in the national interests.

It is obvious that the latter proposition involves some measure of control of mechanical traffic, but if such control is based upon a broad, business-like view of the question, it should occasion no obstruction to industry or hardship to individual commercial interests. Much of the present trouble arises from the unreasonable use of roads and lack of proper regulating powers. For instance, it is obviously not in the national interest that a contractor, in the hope of saving £50 by using motor lorries in the place of horse-drawn vehicles for carting the materials required for a contract, should be allowed to do £1,000 worth of damage to a road quite adequate for ordinary traffic, and which, apart from this one job, is unlikely to be required to again carry mechanical traffic of sufficient weight or volume to cause any appreciable damage. Again, it is not in the national interest that heavy motor traffic should be allowed to ruin residential roads when other roads capable of carrying this class of traffic have been provided and can be used without serious inconvenience.

It is well known that in many localities heavy motors have, without warning, adopted a route over roads unfit for such traffic, which roads have, in consequence, been quickly cut to pieces and, after the highway authority has reconstructed them at great cost, the traffic has been transferred to an entirely new route, where the process has been repeated. Other examples of unreasonable wear could be given, but the foregoing are sufficient to indicate the importance of devising some means by which the use of highways by heavy motor traffic may be properly regulated.

In addition to regulations of this character it is also desirable that the existing regulations as to the construction, loading, and speed of heavy motors should be revised. The author suggests that the regulations relating to vehicles are by no means so important as those relating to the user of the highways by such vehicles, and he is of opinion that the most satisfactory solution of the problem will be found in the direction of the provision of sufficient suitable roads to meet the reasonable requirements of the traffic and by so regulating the user of roads by heavy motors as to prevent undue damage. In these circumstances it may be found desirable, in the national interests, to reduce rather than increase the stringency of the existing regulations under the Motor Car Acts relating to heavy motor cars, and to regulate the vehicles themselves to such an extent only as may be required for public safety, and to prevent unnecessary damage to reasonably good roads.

The main difficulty of local highway authorities in providing sufficient suitable roads is, of course, financial in character, and arises from the fact that they have upon their hands miles of roads without any sufficient foundation, and many more miles coated with materials absolutely unfit for modern heavy traffic, but which have in recent years been called upon to carry such traffic. Where new roads are being constructed the solution of the problem is simple, as it is generally conceded that it is true economy to construct a road in a thoroughly substantial manner in the first instance and thus reduce subsequent maintenance charges to a minimum.

As before suggested, the financial aspect of the question can only be satisfactorily dealt with by a broad-minded and liberal use of national funds and credit.

It has been suggested that the situation might be met by annual subsidies to local authorities towards the cost of the maintenance of their roads. While this course might be adopted to a small extent with some advantage during the few years which should constitute the transition period from bad roads to good, the author is of opinion that it is a policy which is not financially sound, and therefore should be discouraged as far as possible.

Experience has already shown that once a road has been so reconstructed as to carry satisfactorily the traffic passing over it, the annual maintenance charges are almost invariably reduced, so that it is not in respect of these charges that the local authorities require assistance.

At the present time large sums of money are being almost entirely wasted by highway authorities upon patching and repairing bad roads—which never will be good until they are reconstructed—because of the difficulty of obtaining funds to meet the initial cost of such reconstruction. These sums, if capitalised, would, in many cases, be sufficient to cover the initial cost referred to, and in all cases would cover a substantial part of the cost. What appears to be required, therefore, is a system under which the cost of necessary road improvement and reconstruction works would be advanced to local highway authorities, part by way of loan, the repayments of which should not impose upon the authority any appreciably greater burden than they have at present, after allowing for saving in maintenance, scavenging, watering, and other charges, and the balance as a free grant towards the additional cost necessary in the national interest. The Road Board have been working upon somewhat similar lines during the past few years, but to produce the desired effect within a reasonable time the author suggests that the problem must be tackled upon a much larger scale.

It appears, therefore, to be of paramount importance that national funds and credit should be available for road improvement work of a permanent or semi-permanent character to a much greater extent than has been the case in the past. On the other hand, it is essential that care be taken to prevent the National Exchequer from assuming any part of the responsibilities which should rightly fall upon local funds.

As previously mentioned, the greatest difficulty is the provision of money to meet the initial expenditure, and if this is met by the use of the national credit, it is probable that the large sum which will be required during the first few years could to a great extent be repaid by local authorities, so that the ultimate cost to the State need not be heavy.

As a basis for discussion only, the author puts forward the following outline of a scheme for dealing

* Paper read before the Highways and Transport Committee of the recent National Road and Transport Conference.

...ing the place of the question now under consideration.

He suggests the creation of a Central Government Department to discharge the following functions—viz. :—

(1) To consult with local authorities, heavy motor users, carriers and others interested in the subject, and to make full enquiries as to the roads in the country which should be available for heavy mechanical traction, and to classify such roads according to their order and to what extent such roads should be improved.

(2) To ascertain the probable cost of such road improvement works, and to determine the proportion of cost and the amount and rate of repayments which should reasonably be borne by the local authority.

(3) To make orders from time to time, as may be deemed necessary, requiring local authorities to execute road improvement works upon terms and conditions referred to in the previous paragraph.

(4) Where the improvement of roads outside the area of a local authority is primarily required in the interest of the trade of such area, to determine if and to what extent and in what manner contributions towards the cost of such road improvements shall be made by the authority in the interests of whose area they are required.

(5) To advise His Majesty's Treasury from time to time as to the sums to be advanced to local authorities by way of loan for road improvement works, and as to the conditions of repayment, and also as to the grants which should be made for the same purpose, upon the basis of the conditions referred to in paragraph 3.

(6) On the application of local authorities, to make orders from time to time restricting or prohibiting the use of roads by heavy mechanical traction, on being satisfied that they are not reasonably necessary for this purpose.

(7) To collect, tabulate, and publish information, and conduct experiments in reference to the use of materials, plant, and processes for road construction and repair, and the cost of same.

The constitution of such a department as that mentioned above would involve only the extension of the organisation and the increase of the powers of the Road Board. It is generally agreed that this body has already done much excellent work, having regard to the limited means at its disposal, and the author suggests that in the greater work outlined above it would have the full confidence of local authorities and others interested in roads and traffic.

Having regard to the advantages which would accrue to owners and users of heavy motors of all kinds by the reduction of tractive effort required, decreased wear and tear of vehicles, &c., as a result of the provision of good substantial roads with clean, smooth surfaces, it would not be unreasonable that they should be called upon to bear directly some proportion of the cost of the necessary road improvements, and the author suggests that this might be secured by a graduated tax on each vehicle.

[illegible]

The question of regulations in reference to the construction, speed, and loading of heavy motors is of considerable importance if it is assumed that a large proportion of the roads of the country necessary for heavy motor traffic are to remain indefinitely in their present condition with surfaces of ordinary macadam and similar low-grade material. On the other hand, the author submits that if some such scheme for the improvement of roads required for heavy traffic as that already outlined is adopted, this question becomes one of quite secondary importance. The following [illegible]

In the author's opinion the most destructive factors so far as roads are concerned are high speed and small wheels, combined with heavy loading. Even exceptionally heavy loads on wheels of large diameter and reasonable width, travelling at a slow rate, cause very little damage to macadam roads in fair condition, except immediately after a frost, whereas fast traffic on small wheels and with much lighter loads soon causes considerable damage.

It must, moreover, be borne in mind that the better and more regular the surfaces of the roads the smaller the damage, even with this type of traffic, and the damage increases at an alarming rate as the surface becomes worn and uneven.

Given, therefore, a foundation of sufficient strength to carry the weight of traffic brought upon the road, and a wearing coat of material which will retain a smooth and even surface, the factors referred to will not greatly affect the rate of wear.

Under these circumstances it appears to the author that the present restrictive regulations might, to a large extent, be repealed, and that the construction, speed, and loading might be taken into consideration in framing the graduated tax previously suggested. In his opinion more would be gained by encouraging manufacturers to design vehicles which are least likely to cause damage, and carriers to use them in the least objectionable manner, by a direct monetary concession than by imposing arbitrary restrictions which might interfere unduly with important industries.

The author suggests a system of taxation somewhat on the lines of the following formula :—

[illegible]

Total tax to be reduced by 15s. for every 1 in. increase in diameter of wheels over 36 in., in respect of each pair of wheels so increased in diameter.

Total tax to be increased by 30s. for every 1 in. decrease in diameter of wheels under 36 in., in respect of each pair of wheels.

The effect aimed at by this suggested basis of taxation is the encouragement of even distribution of weight, moderate speeds and loading, and of the use of large diameter wheels, without unduly restricting the use of any vehicles which may be necessary for the proper and efficient development and carrying on of any industry.

The following table gives typical examples of the application of the formula :—

[illegible]	W	S	S	T	T¹	Total tax.
				£	£ s. d.	£ s. d.
7 tons	4	3	10	10	1 17 6	11 17 6
	6	1	10	15	0 12 6	15 12 6
12 ,,	6	6	6	12	3 0 0	15 0 0
	6	6	9	18	4 10 0	22 10 0
	9	3	6	18	1 10 0	19 10 0
	9	3	9	27	2 5 0	29 5 0

It is suggested that the width of the tyre should be proportionate to the maximum load upon and the diameter of the wheels, on the lines of the present regulations.

There appears to be considerable difference of opinion as to the relative amount of damage caused by steel and rubber tyred wheels. It cannot be disputed that rubber-tyred motor 'buses are most destructive to ordinary macadam roads, and they also appear to have a damaging effect on roads of higher grades.

The author suggests that the cause of this is probably to be found mainly in the high speeds and small diameter wheels employed. This phase of the question appears to be one which might very usefully form the subject of special investigation.

It is generally agreed that cross-bars should not be allowed on steel tyres, but that, if the grip with smooth tyres is insufficient, the surface of the tyres themselves should be grooved.

The author suggests that all questions as to the construction, &c., of heavy motors is one which should be investigated and considered by a joint committee of road engineers, manufacturers, and users, who should report to the authority empowered to make regulations affecting vehicles of this character.

In conclusion, the author would again emphasise the importance of taking a broad view of the subject. Industrial competition after the war may very likely be as keen or keener than ever, and it is an undoubted fact that improved transport facilities mean increased national prosperity.

Destructors and their By-Products.*

By J. A. PRIESTLEY, Cleansing Superintendent, Sheffield.

House refuse is, of course, a very composite mixture, and different localities have varying constituents making up the refuse, but generally speaking the composition of it differs more in degree than detail. Its composition does, however, affect the question of its disposal, as the percentage of incombustible material determines the extent to which subsidiary methods of disposal have to be linked up with the destructor. In some London districts the combustible as well as the incombustible material is subject to a careful sorting, but I personally have a strong objection to this practice. For the purpose of this paper I propose only to deal with such side products as fish and animal offal, paper, tins and ironware, scrap iron, and glass.

FISH AND ANIMAL OFFAL.

The two first-named are not found in large quantities in house refuse, but every cleansing superintendent knows they are matters he has to deal with regularly. If the quantity is considerable, it is, or rather was, a paying proposition to put down plant for converting them into an artificial manure, and this is more easily done, as this class of refuse usually reaches the destructor more or less separately, and has not to be sorted out from other refuse. The reason I use the past tense is that war conditions have upset the market for this class of material, and we are such a funny nation that, while there is an outcry about the shortage of supplies of artificial manures, the native product has been sent abroad and can still find little or no market at home.. With an organised and educated home market, the utilisation instead of destruction of this class of refuse might be more generally adopted.

PAPER.

Paper forms a very large percentage of towns' refuse, and is easily combustible, but its bulk is far in excess of its calorific value. The difficulty of dealing with it separately is in the question of sorting, but here again I think that its utilisation is a paying proposition. Destruction by fire is not called for by its putrescible quality, and it can be easily pressed into bales, which the paper maker can work up again into a useful commodity. I may provoke a storm of criticism, but I seriously suggest that it is a profligate waste to consign to the flames so much valuable material which can be safely and profitably utilised.

TINS AND IRONWARE.

With tins and ironware their incombustible character necessitates separate treatment, but if this was not so I think a good case could be made out against the destruction of useful and valuable metals. Nations use up the world's mineral wealth year by year with a callous disregard of the possibility of an exhaustion of supplies, and anything which helps to preserve such supply is, in my opinion, worthy of commendation.

Many local authorities in the past have assisted in this matter by disposing of their tins to a well-known firm who profitably utilised them, but the war has upset that arrangement, as it has upset many others. I never had any dealings with this firm personally, as I found I could more profitably utilise the material by the solder recovery process, followed by the baling of the detinned scrap. The quantity of solder used in tins has gradually decreased, until it is doubtful if sufficient can now be obtained to make the recovery of it remunerative. Ten years ago I was able to extract 56 lb. of solder per ton of tins, and as this found a ready sale at from 6d. to 9d. per pound, according to the price of tin, while the cost of extraction did not amount to 15s. per ton, and the resulting scrap had a selling value in excess of the untreated tins, it will be seen that the proposition was at that time financially as well as economically sound. To-day the quantity obtained would not reach half this amount, but a combined solder recovery and detinning process would, I believe, prove profitable. The essentials are a properly arranged furnace, an intelligent attendant, and an undiverted supply of tins, for it is a well-disciplined cleansing department whose depot receives all the scrap which its dustmen collect. If the process only burns off the tin coating it is wasteful, for, thin as such coating is on the individual tin, it amounts in the aggregate to a considerable quantity. Detinned scrap demands a better market than tinned scrap, but a process that loses the tin is not ideally complete, and I look forward to the time when this tin will be recovered.

I commend the idea to the latent inventive faculties of any ingenious member of this conference. Why, for instance, should not the tin volatilised or oxidised and carried off in the flue gases of a solder furnace be recovered in some form of scrubber? Or, why should not those towns in which large quantities of tins are collected establish a process of tin recovery by electrolysis, such as the private firm I have previously mentioned found remunerative, even after paying substantial prices and railway carriage for the tins?

Galvanised scrap finds a ready market anywhere, and even enamelled ware, which was once the rejected of all scrap buyers, may now be treated by a stripping process which preserves for re-use the enamel coating and leaves a marketable scrap for the iron broker.

GLASS.

The last of my side products is broken glass, which, although also incombustible, may, unlike tins, be dealt with in the destructor without injuriously affecting the clinker produced, but which I have found it remunerative to deal with separately. White glass, if it reaches the destructor, may be sold at a good price, and I have found no difficulty in selling bottle glass at 10s. to 12s. 6d. per ton. In the separate disposal of some of these side products I must say, however, I have been assisted by the fact that the destructor at which they were received was hand-fired, and the throwing aside of them required no sorting over of the refuse, to which, as I have previously said, I strongly object. The selection of the refuse with the mechanically fed furnace is a more difficult matter, but has been accomplished in Paris by feeding the refuse on to a transformer belt or conveyor, from which some of the constituents of the refuse are picked off in its course of travel.

HEAT.

The most important by-product is heat, and it is also the most readily utilised. With a properly arranged destructor plant there should be no difficulty in maintaining a constant evaporation of 300 gallons of water per ton of refuse, which, after deducting the power required to work the plant, would leave available a surplus of at least 130 to 150 I.H.P. per ton of refuse burnt per hour.

How this steam should be made use of depends upon local conditions. In some towns the application is at hand, while in others it must be sought. If it can be profitably utilised in the department so much the better. If not, I would urge upon all cleansing superintendents, if possible, to supply "juice" rather than steam to electricity departments.

This at present constitutes the likeliest outlet for the surplus power, but with the advent of the electric vehicle a new demand will be created within the department, and we see the possibility of refuse supplying the motive power for its own collection. In a small town this service added to the supply of power and lighting for depot purposes, mortar grinding, clinker crushing, flag making, solder and tin recovery, baling processes, fish manure plant, repairs, workshops, and similar undertakings, may absorb the bulk of the power produced, but in large towns there will remain a considerable available supply of surplus power, which could pump "juice" into the electricity department's mains to the extent of thousands of units per day. When we leave heat we come to by-products, the utilisation of which demands very much more ingenuity, and I am bound to confess that the solution of the residuals problem has not yet been reached.

RESIDUALS.

Grouping together the three residuals, ashes, clinker, and flue dust, we have left on our hands practically one-third of our original weight of refuse. This residue is innocuous, it is true, and may be tipped away without the objections on sanitary grounds to which tipping towns' refuse gives rise, but it is a sorry ending to our attempt to find a use for everything. Mortar, crushed clinker, concrete flags, and disinfectant powder all afford an outlet for small quantities of residuals, but they only absorb a fraction of the total production. Filter beds at sewage works

also use up some, but the demand is neither constant nor regular. How then has it to be utilised?

I thought a few years ago I had found a solution in brick making for sanitarians; and an inherent fault were too many for me at the time. I still think, however, that the experiment was on right lines, and I am sanguine enough yet to expect developments in this direction. A brick was produced at a reasonable cost which was hard, sound, and improved on keeping. It had two faults, the second of which was the sequel of the first. It was too absorbent, though not more so than many varieties of bricks in use to-day, and after soaking it threw off excessive quantities of sulphate of soda on drying. Given an unprejudiced trial for the clinker brick, I see no difficulty in getting rid of the sulphur in the clinker by suitable treatment, and in reducing the porosity to a minimum by finer grinding of the ingredients.

"B.R.C." REINFORCED CONCRETE ROADS.

The [illegible] road laid to carry [illegible] traffic in this country has been many, but we doubt if any [illegible] with this interesting departure in highway engineering goes much beyond the information that is available in the [illegible] on the subject. Not a few to whom this simple means of effecting a much-needed strengthening of their roads has been suggested have immediately put forward as a drawback to the system the restrictions that it is likely to impose on the gas, water, and other departments of the public service who so frequently find it necessary to make openings in the roads for the laying or repair of mains; and if it results in nothing more than removing misconceptions of this kind, an inspection of some reinforced concrete roads in course of construction in the neighbourhood of Swindon that was made last Friday by some seventy surveyors and others will not have been in vain.

When it is stated that the lines in question about 3 miles in all and [illegible] form an important part of the means of communication in Chiseldon, it will be realised at once that the military authorities are [illegible] such matters are compelled to the [illegible] the reinforcement of high [illegible] and in adopting the "B.R.C." system of the British Reinforced Concrete Engineering Company, of 82 Victoria-street, Westminster, and Manchester, at whose invitation we took part in last Friday's inspection, they would appear to have selected a method of construction that is remarkable both for its simplicity and apparent cheapness.

The company's guests had an opportunity of seeing two roads of different widths which have been reinforced with the "B.R.C." fabric. One of these, which, by the [illegible] is 700 ft. in length and 20 ft. in width. It was originally intended to have an asphalt finish on this, but the officer commanding was so satisfied with the concrete surface that it has been left rough, and will take the wear of the traffic. This particular road is provided with kerbs, in which there are weep-holes to permit of the rain water running away; the other road is 15 ft. in width, with a concrete surface finished smooth, and, as in the case of the other road, it is intended to run the traffic on the concrete. Each road is 6 in. thick. The 20-ft. road will carry fairly heavy traffic, and the 15-ft. road light traffic.

In the operations at Chiseldon there is first put down a layer of cinders, compressed and levelled by means of a roller to a depth of 3 in. The reinforcing material is laid over this, concrete—mixed on the spot and deposited as fast as required by two [illegible] mixers—being then applied and finished off in the usual way. The rapidity with which the work in this case of course, greatly facilitated by the [illegible] mixers referred to is carried out was generally commented on, and it is safe to say that at the end of the inspection there were among the company quite a number of fresh converts to the reinforcement system. The demonstration proved to the visitors that the "B.R.C." fabric, although composed of a continuous mesh of drawn steel wire cross-welded at every point of contact, and of great tensile strength and elasticity, can when bending becomes necessary be cut through quite easily, the wires being comparatively thin; further, that the effect of the fabric is to spread the load over a large surface of the under bed and thus reduce the stress immediately below the point of impact—in short, that a road bed thus reinforced becomes an efficiently connected slab, which evenly supports the [illegible] wearing surface, prevents subsidence and local fractures, and maintains the road in good condition. It may be added that the installation of the reinforcing material—which is supplied in rolls about 6 ft. in width and 240 ft. in length—is quite an easy operation; it requires no skilled labour and the minimum of supervision.

It only remains to say that all who participated in last Friday's proceedings were unanimous in their praise of the excellence of the arrangements made for their comfort by the "B.R.C." Company. Special

"B.R.C." Roads at Chiseldon.

carriages were attached to the 10.50 train from Paddington, and at Swindon the party were entertained to an excellent lunch, at which Mr. J. Hall, chairman of the company, presided. The journey to and from Chiseldon was made in motor omnibuses, and London was reached again about 7 o'clock.

Workmen's Dwellings in Pretoria.—The Municipality of Pretoria have recently had under consideration the question of the erection of workmen's dwellings. The burden of heavy rates falls heavily on workmen, and in extension of the area of the town are taken on the nature of lines. A committee who were appointed to enquire into the matter have reported favourably on the matter, and recommend that a beginning should be made by the erection of twenty four cottages, each consisting of two rooms, pantry and bathroom, to cost approximately £250 each complete. It is proposed that these cottages should be let at a rental of £3 per month.

National Road Conference.

SECOND SITTING: DISCUSSION ON HEAVY TRAFFIC.

At the second sitting of the recent National Road Conference, which was presided over by Colonel Dixon, the subject for discussion was "Heavy Traffic"—introduced in papers by Mr. E. J. Elford, M.INST.C.E., M.I.MECH.E., borough engineer and surveyor of Southend-on-Sea, and Mr. Harcourt E. Clare, clerk to the Lancashire County Council. The two papers appear elsewhere in this issue.

Mr. Ferard (chairman of the Highways Committee of the Berks County Council) said he thought they had a remedy for dealing with heavy traffic by an appeal to the courts on questions of extraordinary traffic, but at present the small local authorities were unable to seek such a remedy because they were faced with strong insurance bodies who took them from court to court. Above all they must have a central authority, and he thought the Road Board, with extended authority, would satisfy them. He had one qualification to that, which was that such a central body must not be exposed to the influence of Parliament. If politics were going to enter into their roads there would be an end of them. If grants were to be dependent on votes they would do nothing.

Alderman Lloyd (chairman of the Highways Committee, Bristol) expressed the view that some equitable means should be arrived at by which those who carried on the heavy traffic should be made to pay a due amount towards the upkeep of the roads.

Mr. H. Copnall (clerk to the Nottinghamshire County Council) remarked that, as regarded extraordinary traffic, the present procedure was about as unsatisfactory as it could be, and he suggested that a good deal of litigation might be avoided if notice was given to the highway authority by the persons who were going to put such traffic on a road. Then a tribunal might decide whether the road required strengthening, and, if so, the work could be done, and contributed to by the user. He felt that the time had come for the amalgamation of the laws relating to mechanically propelled vehicles. He approved of the suggestion to have a central authority, and thought they had seen enough of the Road Board to have confidence that they would do what was fair for the local authorities, and would not be moved by party political influences.

Mr. Eames (Winchester) agreed that people who used the roads should pay a reasonable sum towards maintaining them.

Alderman Muirhead (Liverpool) expressed the view that if there were to be charges of any kind on motor traffic, it must be Imperial and not local, because there were many conflicting interests in different localities.

Mr. R. W. Cass (surveyor to the Farnham Urban District Council) remarked that traffic on a road before it was set would absolutely destroy the road, and he suggested that some power should be sought which would allow the temporary closing of roads against exceptional traffic. He had had one or two deplorable experiences. Had he had notice of the traffic which came on to the road and did enormous damage, he could easily have diverted it. Another thing which did great damage was the dirty traffic, and he suggested that the County Councils Association should take that into consideration. He had endeavoured, by private appeals, to get farmers to clean their cart wheels, and so saved great damage to the road, but had failed to get them to do so.

Alderman Bain (Chatham) said he thought there should be some method of taxation in order that the expense which fell on the local rates for the upkeep of the roads should be mitigated to some extent.

Mr. Dent (chairman of the Highways Committee of the Essex County Council) pointed out that all previous experience had shown that it was impossible to try and limit the development of any particular traffic, and the only alternative was to make roads to carry the traffic.

Alderman Patterson (Kesteven County Council) said he thought the duty of maintaining the roads should be a national matter, because it was not fair that poor farmers in a small county should have to pay for the upkeep of roads used by huge motor tractors which simply pass through the county.

Mr. Lindley (Godstone) considered they ought to get the extreme weights, the width of tyre, and the speed at which motor vehicles should travel; then surveyors would be in the position of knowing what it was they had to provide for.

Mr. G. A. Hutchins (county surveyor, Montgomeryshire) said the agricultural counties felt themselves perfectly safe in the hands of the Road Board. They should encourage the use of highways, but discourage their abuse. He agreed that the Road Board should appoint a tribunal which, before extraordinary traffic came on a road, should decide what those who were to use the roads should pay.

Mr. Churchill (Imperial Motor Transport Council) said there was an undue tendency to regard motor traffic as extraordinary traffic, but he suggested that the view should be taken that what was extraordinary traffic to-day would be ordinary in the future, and they should therefore hesitate before making any suggestions towards the direct taxation of traffic which in a short time would not be looked upon as exceptional.

Mr. Newcombe (Warrington) said the conditions of Lancashire were advanced on those in any other part of the country, for there was a tremendous motor traffic from all parts to all parts, and it had got far beyond the stage when the law regarding extraordinary traffic was of any use. The iron-tyred vehicles which did most damage paid nothing, and he considered the rubber-tyred vehicle should be encouraged.

Mr. F. Reid (surveyor to the Gelligaer Urban District Council) pointed out the damage which was done by motor vehicles by slips on hills. He thought it was quite possible to limit speed. He agreed generally with Mr. Elford as to taxation.

Mr. F. Wood (borough engineer of Fulham) said he did not see how they could consider this question without also considering the foundation of roads. In his opinion horsed wagons heavily loaded did more damage than motor vehicles. Heavy motor traffic certainly did damage roads which were not satisfactory in their construction. In the Fulham-road 75 per cent of the traffic was motor traffic, and a large proportion of that was 'bus traffic. Between 20,000 and 30,000 tons a day passed over the road, but the wood paving of the road was costing less to repair than it did five years ago, although the traffic had increased by 45 per cent. The wood paving was actually lasting 25 per cent longer. That indicated conclusively to him that if a road was properly constructed it would last at a much less cost than macadam roads at the present time. The steel tyre was doing some damage to the road. In his opinion there ought to be no taxation at all on vehicles.

Mr. H. W. Bowen (county surveyor, West Sussex) said that the Departmental Committee which was considering the matter ought to consider the section of the Locomotives Act which permitted a heavy locomotive to go into an adjoining district by the payment of 2s. 6d. extra licence. He had the case of a traction engine coming from an adjoining county, and loaded up sixteen or eighteen trees. Another point was the great damage done to bridges and culverts. His authority had just adopted a by-law by which they could fine owners of heavy vehicles which stood on bridges and culverts.

Mr. H. T. Wakelam (county engineer, Middlesex) said that if they took Mr. Wood literally then the motor vehicle was an improved form of steam roller which did good wherever it went. That, however, was contrary to their experience in Middlesex. There was no doubt that the speed of motor 'buses was doing the damage to the roads at present, and he had an illustration of that in the case of Stanmore Hill. Going up the hill the 'buses could not travel more than 4 miles an hour, but on the top they gathered speed, and there they found great damage to the road. It was speed and the unequal distribution of the load. They had had to reconstruct a number of roads in Middlesex in the last few years owing to the motor 'bus traffic. Mr. Wood said the motor vehicles did not damage wood paving; but they had found that wood paving which in the ordinary way lasted ten years had since the advent of motor traffic had to be relaid in seven years. Taking 15 miles of road, they found there was a total tonnage of motor-'bus traffic of 21,352,500 tons against 16,298,162 tons of other vehicles, and if that was not extraordinary traffic he did not know what was. He agreed that they should have some tribunal to take these matters

into consideration, and deal with them on an equitable basis.

Mr. W. FINCH (county surveyor, Cumberland) said they had many mines and quarries in his county which used to convey their material in carts, but now had mechanical haulage. Up to now the council had not thought it worth while to make any claim for damages, but they did think now, in consequence of the heavy expenditure on the roads, that something should be done. Probably it would be arranged that the companies should pay something.

Mr. CLARE, in reply, said everyone had the right to use the highways, and it was the duty of highway authorities to make their roads fit for traffic; but they were faced with the fact that certain persons, for their own profit, had utilised that public right exceptionally, and to an extent which was unfair to the general public, and the real question was whether the general public would not, for their own protection, ask Parliament drastically to limit or abolish that general right; or would all the parties interested join together and agree upon some sort of Order which might be made by a Government department without altering the general law? He suggested that the latter would be more advisable, and the easiest course to follow, and the one most probably more in the interests of those interested in heavy motor traffic. As to taxation they must remember that no taxation could possibly be imposed on these vehicles which would produce a sum of money which would in any way meet the cost of the damage they did to the roads. What they wanted to do was to introduce a new item of revenue by placing on the users of these heavy motor vehicles a reasonable tax, which would not be sufficient to stop them, but which would not be unfair to them, having regard to the profits which the users made out of them. He agreed with what Mr. Wakelam said about motor 'buses, which was confirmed by their experience in Lancashire. He thought the road authorities should ask the Road Board to appoint a committee to discuss whether it was possible to agree upon some common basis of conditions which would minimise the damage, make the burdens more fair, and enable the traffic to continue with less annoyance to the general public.

Mr. ELFORD said he agreed that there were many individual cases of great hardship, but they must take a very broad view of the question. Increased facilities for transit in the end made for national prosperity. Very few improvements were inaugurated which did not result in some individual benefit, and someone had asked who gained a profit from heavy motor traffic. He made bold to say that the greatest gainers were the members of the community generally. The private benefit which had been spoken of generally in tones of complaint is the one thing which encouraged the enterprise, which was the only thing they could rely upon in this country for the introduction of improvements in various directions, and which were so essential in the national interest.

Sir GEORGE GIBB, in proposing a vote of thanks to the chairman, said that, when Mr. Wakelam asked if the traffic he alluded to was not extraordinary traffic, it occurred to him, from the figures, to ask, "If it is not ordinary traffic, what is?" Mr. Clare had suggested that a committee should be formed for the matter to be discussed by the highway authorities, the road users, and the owners of road vehicles, but there was no doubt all these interests would be giving evidence before Mr. Short's Departmental Committee, and they might have the greatest confidence that the committee would come to a wise and sensible conclusion on the matter. Possibly, before evidence was given as regarded regulations, it would be well to have a discussion between the parties interested, and if the Road Board could facilitate a discussion of that sort by taking an informal part in it they would be glad to do what they could.

Sir J. MACDONALD, in seconding the motion, said that seven or eight years ago Mr. Fell, of the London County Council Tramways, announced that in another ten years no motor 'bus would be seen anywhere except in a museum. He thought it more likely that it would be the tramcar which would meet that fate if the door of any museum was large enough to allow such a menagerie to go through.

The motion was carried, and the meeting adjourned.

(To be continued.)

Wearmouth Bridge Reconstruction Deferred.—It has been decided to defer for the present the reconstruction of Wearmouth Bridge.

CORRESPONDENCE.

Εις ἀνηρ οὐ πανθ' ὁρᾶ.
(One man does not see everything.)
—EURIPIDES.

MUNICIPAL ENGINEERING WAR-TIME APPOINTMENTS.

To the Editor of THE SURVEYOR.

SIR,—From this week's SURVEYOR I learn that you have very generously offered to compile a list of retired engineers who are willing to take up work again for the duration of the war.

I would be quite willing to take up any useful work, and would be much obliged if you would put my name on your list.

I retired some six years ago at an earlier age than is usual, and am now not old (fifty-three years), and in the best of health, and, thanks to continuous golf up till the outbreak of the war, I was never fitter in my life, or better able for work.

My degrees and diplomas are: M.C.E. (Honoursman, Master of Civil Engineering); Assoc.M. Inst.C.E.; licensed municipal engineer; licensed land surveyor (under Transfer of Lands Act, Victoria and West Australia); licensed mining surveyor (West Australia); and I have testimonials covering the whole of my thirty years' experience.

I would be willing to take any post, either as engineer or surveyor, or even as an assistant to a municipal engineer or borough surveyor, for the duration of the war. . . .

I have had a varied and unusually valuable experience in several parts of the world, especially Australia, where I built 500 miles of roadway, partly in West Australia and partly in Victoria and Tasmania.

It will be a great relief to me in these terrible and troublous times to have some occupation, and I am certain that I can give services of unusual value to any borough or municipality, and will be glad of any opportunity of doing so.—Yours, &c.,

J. H. L.

July 2, 1915.

To the Editor of THE SURVEYOR.

SIR,—In this week's issue of THE SURVEYOR I note from the "Correspondence" column to what good use you have placed my letter of the 21st ult., and I gratefully thank you. It was only after seeing the editorial paragraph in your issue of June 25th that such an idea occurred to me—as placing myself, with your permission, on your applicants' list, and your initiative in doing this for me is much appreciated.

In the furtherance of such a project as bringing my services before anyone I shall only be too pleased to supply any additional particulars to those handed you in November, 1913, together with plans, specifications, &c. Enclosed is a copy of testimonial I have since had given me—*i.e.*, since supplying you with particulars in November, 1913—if it is of any use.*

In my letter of the 21st ult. I mentioned having made application to the Road Board for an opening, and I have since received a reply that the board have no vacancy on their engineering staff.

Trusting to hear some good of your project, and again thanking you.—Yours, &c.,

F. N.

July 3, 1915.

[* The testimonial referred to certifies that "F. N." has acted as assistant road surveyor under a county council for some two and a-half years, and as interim surveyor for the county a further four months, and gave "every satisfaction."—Ed. THE SURVEYOR.]

To the Editor of THE SURVEYOR.

SIR,—The letter from "Ploughboy," in your last issue, is rather curious reading. Here is a man, presumably of military age, who is unable, or unwilling, to join the Forces because he has a wife and a mother dependent on him. At the same time he confesses he is unable to obtain any work. Surely half a loaf is better than no bread, and it appears to me that it would be better for this young man to defend his wife and mother by fighting rather than to be idle; or he might help to make munitions, or do anything rather than work which could be performed by old men, or men physically unfit for fighting, though quite capable of performing the duties of a surveyor. Let "Ploughboy" remember that there are thousands of married men who have joined the Colours, and that even the small allowance made to their wives and mothers is better than starvation, and that unless every capable man in this country takes a hand in

fighting the Germans they may eventually come here and then God help all mothers and wives!—Yours, &c.,

SENEX.

July 6, 1915.

To the Editor of THE SURVEYOR.

SIR,—I am pleased to see your remarks to my letter marked "B." in this week's issue of THE SURVEYOR, p. 17, which I much appreciate.

I will, with your permission, say my position is that of assistant engineer to one of our chief English cities, and permanent; but, nevertheless, I am anxious to do something for my country by relieving a man of military age. At the same time I desire to hold a chief appointment, and more particularly having been a chief engineer and surveyor.

I think if any authority should require the services of an engineer and surveyor to take the place of a chief going to the Front, or elsewhere, and it was offered to me, and the salary adequate, as I am married and have a family—I would submit the matter to my chief for his permission of absence during the period of the war, or of a longer duration, or permanent.

This is, I am afraid, the only course open to me to serve the country at the present crisis.

With many thanks for your esteemed and kind consideration.—Yours, &c.,

B.

July 2, 1915.

To the Editor of THE SURVEYOR.

SIR,—Having seen your article on "Municipal Engineering War-time Appointments," I take this opportunity of placing my case before you.

I am twenty-five years of age, and was an engineering student at Queen's University, Belfast. I have had three years' practical experience in steam-rolling work, and have just completed an appointment under the War Department as clerk of works over the entire construction of a military hutted camp—for two battalions—including the buildings, drainage, water supply, and construction of the roads. Owing to this camp being now completed I am unemployed, and would be very glad to get an appointment as clerk of works over a steam-rolling or drainage contract—preferably in Ireland. My testimonials are excellent.

I am ineligible for military service owing to defective eyesight.—Yours, &c.,

C. S. F.

July 5, 1915.

To the Editor of THE SURVEYOR.

SIR,—I beg to submit my name and address for your list of applicants *re* above. . . .

Owing to health reasons I was compelled to resign my last post under a county council. Having recovered satisfactorily, and received permission from a specialist to restart work, I am desirous of doing something in this crisis in our country's affairs.

I am willing to take a subordinate position, such as superintending steam-rolling operations, or such kindred work. . . .

I am not eligible for the more strenuous work of active service. I am thirty-nine years of age, and a total abstainer.

I must say that I greatly appreciate your efforts in this direction.

I can submit excellent testimonials.—Yours, &c.,

H. L. T.

July 4, 1915.

To the Editor of THE SURVEYOR.

SIR,—I notice in the current issue of THE SURVEYOR that you are registering a list of men professionally qualified and desirous of assisting local authorities temporarily, and I shall be much obliged if you will add my name thereto.

I am forty-two years of age, and married.

In addition to holding appointments in Canada and Nigeria, I have had a thorough training and experience in municipal work in this country, having served my articles here some fifteen years ago, and also worked under a corporation and a county borough.

I am desirous of assisting in any of the usual work of an engineer and surveyor's department, indoor or outdoor.

I may mention that I am practically an abstainer, and of steady and regular habits.—Yours, &c.,

W. P. F.

July 1, 1915.

To the Editor of THE SURVEYOR.

SIR,—I should feel exceedingly grateful if you would kindly include my name in your register.

Owing to projected works being cancelled on account of the war, my appointment as an assistant in a borough surveyor's department is to terminate.

My age is thirty-seven, and I have a wife and one child dependent upon me. I am ineligible for the army, being unable to pass the sight test. Good draughtsman, surveyor and leveller; can use theodolite; architectural and building and general routine work. Can submit testimonials. Should prefer a southern district, if any choice.—Yours, &c.,

F. J. W.

July 2, 1915.

THE CITY OF LONDON CORPORATION AND THEIR EMPLOYEES.

To the Editor of THE SURVEYOR.

SIR,—I read with some regret the "Minute" in your issue of the 2nd inst. with regard to the action taken by the City of London Corporation in not increasing the wages of their employees who were of military age. While agreeing with you that compulsion is to be deprecated, at the same time I feel that there are a large number of men in this country who from one cause or another are shirking their duty. There are still left a very large number of men of military age doing work which could equally well be performed by old men or by women. To encourage such men by increasing their wages or salaries at this juncture would, in my opinion, be unpatriotic and ill-advised, and would be putting a premium on pusillanimity. Do we yet realise that unless every able-bodied man in the country puts his shoulder to the wheel now, and at once, very serious results may follow, and that every moment of delay means the death of some of our gallant defenders?

I feel sure that your "Minute" was not intended to discourage men from doing their obvious duty, but I still feel that the action of the City Corporation is right, and one that should be universally followed.

The fact is that England is too safe, thanks to our splendid Navy and to the absence of frontiers, but there may be a rude awakening some day if the manhood of this country do not realise that every bit of energy we possess must be used in only one direction until the awful shadow, which of a surety now threatens us, is dispersed. The only way in which this can be effected is by every man of fighting age in the country taking his part in the war. To stay at home and to let others fight for him is not the attitude of mind to be encouraged by an increase of pay. No patriotic employer should deal with such shirkers in that manner—rather should they say: "You are wanted elsewhere. Go at the call of your King and country; I have no place for you."

Let me in conclusion quote two lines from Macaulay's "Lays of Ancient Rome":—

> "Shame on the false Etruscan who lingers in his home,
> When Porsena of Clusium is on his way to Rome!"

Let every "Britisher," whether an employee of the City Corporation or not, ponder on these words and take them to heart.—Yours, &c.,

M.Inst.C.E.

July 5, 1915.

[There is really not much difference of opinion between us and our correspondent. With the contention that every eligible man should now be serving his country, as our correspondent urges with such truth and spirit, we agree unreservedly; but so long as service is voluntary we submit that attempts to *drive* men into service is illogical and unwarranted. While holding that the City Corporation methods were wrong, we by no means implied that the action of "shirkers" is right. Ed. THE SURVEYOR.]

Refuse Destruction at Sutton Coldfield.—The refuse destructor erected near the electricity depot in Rylandroad, Sutton Coldfield, at a cost of £5,500, was formally opened last week. The plans were devised with special reference to the preservation of the residential character of the borough, and the avoidance of any dust or other nuisance arising from the tipping and burning of the refuse. There are three destructor furnaces, and the steam generated is utilised in the production of the day load at the electric light works adjoining.

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING IN LONDON—(3).

The first papers to come under discussion at the annual meeting of the Institution of Municipal and County Engineers dealt with the subject of mechanical traction for municipal work, and were contributed by Messrs. E. J. Elford, M.INST.C.E., borough surveyor of Southend-on-Sea, T. W. E. Higgens, ASSOC.M. INST.C.E., borough engineer of Chelsea, and F. W. Smart, chief engineering assistant, Bedfordshire. All three papers were reproduced in our issue of last week.

Mr. A. E. COLLINS (Norwich) said the three papers supplemented each other in a way that was very convenient to discuss them together. He could not start better than by strongly emphasising what Mr. Elford had said. All the difference between economy and loss on mechanical haulage was made by quick or slow loading and discharging. Taking Mr. Smart's figures of a total working hours of 7,584, the actual outward journeys were 1,738 hours, or little more than one-fifth of the total number of hours the machine was at work. Supposing Mr. Smart was able to halve his number of hours for loading and unloading, he would get more than double the amount of work out of his motor lorries. Even the figures which were given by Mr. Smart were wonderfully better than those which the railway companies could get. If the railway companies could get 2 per cent, they considered they were doing very well. Mr. Smart was getting more than 20 per cent out of his motor lorries. He had always been interested in this subject of the use of heavy motor vehicles on roads. The steel-tyred vehicles, for ordinary setts, were very destructive, though less destructive for macadam and wood blocks. Most of the destruction was due to the small canter of the wheels and the excessive loads. It was no good allowing a wheel to be of a width exceeding what could distribute itself on the road. If they had wheels beyond 6 in. in width, they did not get very much distribution of the weight on the road. The contour of the road varied so much. It appeared to him that where great widths were allowed to come the wheels ought to be mounted. In that way they would prevent the great destruction of the road by more fully distributing the load. Where coal was used the authors did not state what kind of coal was used. He had tested coal and coke, and he found that 1 ton of Welsh smokeless coal did as much work as 3 tons of coke. With coke at 20s. and Welsh coal at 32s., there was a great economy in the use of coal. He had very little experience with electric vehicles—not enough to say whether they were economical or not. He was, however coming to the conclusion that the electric-propelled vehicle was about the best for ordinary town work. They were so cleanly, so quiet, and they required no skilled labour. The steam wagon required a good deal of looking after, and the services of two men; whereas the electric vehicle only required one man. Present conditions pointed to the electric vehicle superseding the others for ordinary town work.

Mr. J. W. COCKRILL (Great Yarmouth) said he had had some experience lately with mechanical haulage. His was a town of long distances and small means. The council purchased, on his recommendation, eighteen months ago, one steam wagon, at a cost of a little over £500. No sooner had he got it at work than he was able to prove that they were saving 40 per cent on the cartage bill. He had since bought a second and a third steam wagon. He arranged with the borough accountant that the depreciation of the wagons should be charged over a period of eight years; that was to say, that they set aside each year to purchase a new wagon every eight years. That, he found, was a good allowance. Then he arranged that the cost, including depreciation, should be allowed for each job, and on that basis he was allowing 25s. a day for the use of each vehicle. Mr. Elford had put down his cost at £1 9s. 1d. per day. Only the previous week the borough accountant came to him and said: "You are giving me ever so much too big a figure for your steam wagons. I have got over £250 saving on the three wagons on the year." So the cost worked out at about £1 a day, and he was now arranging that a charge of £1 1s. per day should be made. That cost was much lower than Mr. Elford's figure of £1 9s. 1d. per day.

Mr. C. H. COOPER (Wimbledon) said it had been very difficult in the past to get any figures, and certainly these papers did give them actual figures. There was one point the addition of which would add a good deal to the interest of the papers, and that was the average length of the journeys. That in the past had been the determining factor as to whether motor haulage was cheaper than horse haulage. The last time he went into the subject rather thoroughly, 6 miles was about the limit at which motor haulage successfully competed with horses. Below 6 miles horse haulage was, at that time, the cheapest. But with the improvement in motor vehicles that had been much reduced. With regard to electric haulage that seemed to adapt itself better for shorter journeys than either petrol or steam; but if electric haulage came in it must not be with the type of vehicle adopted at Barnes. In that case the loading of the refuse was done by the dustmen having to mount a ladder. That was just contrary to what Mr. Collins had said about slow loading. That type of vehicle was absolutely useless for municipal work. If they went to Paris they would see that they were using a low-bodied vehicle, which was easy to load. New York had also a very good type of vehicle; but they could not get them built here. The great drawback was that they had not got a vehicle adapted to their use.

Mr. E. WILLIS (Chiswick) said that Mr. Elford mentioned a flat-topped trolley the peculiarity of which was not having a driver's seat. Would he give the maker of that vehicle? In Mr. Higgens' paper he should like to ask whether the cost of drivers' wages, at £1,086 16s., included any payment for overtime, and if the overtime was paid at the ordinary rate. Then there was another curious figure in Mr. Higgens' paper—the very large reduction in the cost of maintenance per annum when the machine was wearing out. The maintenance for the eighth, ninth and tenth years was only £40 per annum, whereas in the earlier years it was £57, £75 and £60 per annum. Then he wished to ask whether there was any reason for the serious difference in the consumption of oil between No. 2 and No. 3 motors. There was no apparent relationship between the length of the journeys and the total hours worked, and the consumption of oil. Then, taking Mr. Smart's paper, could he give them any special notes of the hours in conjunction with the periods of loading and unloading? He had at present two motors on order, and was having them built with drop back axles, so that the total height was only 4 ft. 6 in. above the ground, so as to simplify loading. These motors were to be used for watering and the haulage of material. Would Mr. Smart give the name of the maker of the tyre which ran so excellently, and for such long distances? Mr. Smart mentioned the difference in the cost between horse haulage and motor haulage. He should like to ask whether that included the unloaded journeys as well as the loaded journeys.

Mr. J. DIGGLE (Heywood) asked whether there were any towns of small population which were using these motor vehicles, because it seemed to him that unless they used a large number of them, and had a workshop of their own in which to make repairs, they would not compete with horse haulage.

Mr. W. A. FARNHAM (Foots Cray) said the papers dealt with widely varying conditions. They had in Mr. Higgens' paper motors employed in a metropolitan borough of small area and large rateable value, while Mr. Smart's paper dealt with a large area of small rateable value. Mr. Collins had told them that the profitable time of a motor was the running time, and that the standing time was the lying idle of £500 of capital. From his experience and observation he had come to the conclusion that the tractor with trailer was the most suitable type for heavy haulage for county work. It was possible to have one trailer running, and one standing to be loaded or unloaded, so as to keep the tractor constantly at work. If they had simply the motor it might be employed for hours getting a load, and then have only a short journey to the tip. It was a pity they had not arrived at the type of vehicle which, for the want of a better name, he would call the one-horse type. He thought they would ultimately reach that stage, and the question of traction would then be solved.

Mr. H. Gullan (Belfast) said the relative case of horse haulage as against mechanical haulage was where was the most economical. He came from a town which had the cheapest horse haulage he knew. It lasted up to last year a man supplying a horse, cart and man for 5s. per day. (A Voice: Shame!) There were some advantages of living in Ireland. The new contract entered into two years ago was 7s. 6d. per day for the same work. It was a difficult proposition for motor haulage if they had to compete with prices like that. He had had a steam motor for the last seven years, and, having regard to the fact that his cartage contract was at such a wonderfully low figure, he had taken extra care to watch his motor cost. The motor had been running with a trailer behind, and so they got the benefit of the tractor plus the amount of material they could carry on the trailer. The price they charged for the motor was 25s. per day. Every job done by the motor was charged at that rate. Every year, up to last year, that about paid itself. Last year they had to increase the wages paid to the driver, and the cost worked out at 28s. 6d. per day; so they were going to charge 30s. per day on the increased cost of working. There was one factor of importance—that was the human element. It was wonderful what a difference a careful driver made in the upkeep of a motor. The last man he had—he was at the Front now—the expense for running power was cheaper than during the time when the motor was driven by the man who came over from the works in Lancashire. One big expense was the upkeep of the rubber tyres. The upkeep of rubber tyres must run to 5s. per day on a petrol motor. This in itself was a pretty big item.

Mr. O. E. Winter (Hampstead) said that at Hampstead they had had experience with mechanical traction for ten years, having used two of Thornycroft's steam motors of the water-tube type. At the end of that period they found the upkeep was getting considerable, costing £100 per year for repairs, and they ultimately disposed of them. Even those vehicles were found economical as employed under certain conditions as compared with horse traction in the hilly part of the district, especially in street watering, and the haulage of street material where good long runs could be secured. For the collection of dust they found they did not compare with horse haulage. For two years he was able to hire a steam motor of a locomotive type at 4s. per hour actual running, or £2 a day. There were interchangeable bodies—one for haulage of material and the other for street watering. Last year he had the opportunity of trying the Edison electric accumulator motor made by that company. It was a 2-ton van, did the work very satisfactorily, and the price would be favourable as compared with horse haulage. Unfortunately, the first cost of these vehicles was rather large—much larger than he could induce his committee to spend at the present time. The Electricity Committee, however, were anxious to get an output for electricity by this means. He had been able to come to an arrangement with the committee to purchase a van for a period of four years, and they would hire the van to the works department at the price of 3s. 6d. per hour, or 35s. per day, for a period of four years. That was a 3-ton van, with rubber tyres and an interchangeable body which could be used for dust collection or street watering. He had no doubt at that figure he should be able to make a considerable saving over horse haulage. In dust collection it would have an advantage over steam or petrol, as there was no waste when it was standing still. It had also the advantage in residential districts of being smooth and quiet in running. In all towns the use of steel tyres should be limited, and nothing above a certain weight should be provided for rubber tyres. Mr. Cockrill had given a very low figure for his steam van. He was at Yarmouth recently, and saw this van going along one of the roads. It was smoky and noisy, and did not add to the amenities of Yarmouth; certainly it would not be tolerated in Hampstead. One very critical gentleman in his district wanted to know, with the steam motor he had, and in which Welsh smokeless coal was used, whether he was going to turn his road into a railway cutting.

Mr. J. F. Smillie (Tynemouth) said that, in the estimates which had been put before them, Mr. Elford writes off the cost of his machine in ten years, Mr. Smart in fourteen years, and Mr. Higgens in twenty years. The costs were considerably affected by these discrepancies. He should like to know whether these figures were mere arbitrary estimates or actual experience of the life of the motor.

Mr. A. J. Lyddon (Essex County) said the charge of 1s. 7d. per gallon for petrol seemed rather high. In Essex they were paying 1s. 1½d.; less duty the cost was 1s. per gallon, which made a considerable difference in the running cost. Would Mr. Higgens say what "contractors' maintenance" really meant? In the motor to which he referred there was a big item for repairs in addition. Then, with contractors' maintenance, was that one of the conditions of the purchase of the machine? It seemed a very favourable condition. With regard to the cost of collection of house refuse given by Mr. Higgens, it was very difficult to make a comparison; but one would like to know what the average cost was per ton-mile. They had seven tractors, each with two trailers, and the cost worked out at 4d. to 5d. per ton-mile compared with horse haulage of 10d. per ton-mile. They had also steam lorries, and there again they found a considerable saving as compared with horse haulage. There were certain conditions which seemed to limit petrol as compared with steam.

Mr. W. H. Eley (Newmarket) wished to ask one or two questions on these papers. First, Mr. Elford estimated that one hour lost with the tractor equalled five hours' loss with a horse and cart. Was he to understand that this tractor was equal to five horses and carts? Secondly, he would be glad if Mr. Elford could give him any figure about the comparative cost per ton-mile between petrol and steam wagons. Then what was Mr. Elford's experience with regard to the life of rubber tyres? Then, with regard to the contract system of maintenance of tyres, what system was adopted to be satisfactory to the council and the people who contracted to keep the number of miles run? Then, did the author allow for extra wear and tear on roads, when using these motor vehicles, in the prime cost? The figures quoted agreed very fairly with figures supplied to him. With regard to Mr. Higgens' paper, he should like to know the number of miles run, the number of wagons running, and when the repairs became excessive. Then he should like to know the cost of the collection of refuse per ton-mile as compared with horses and carts, and what consideration led the author to advise steam wagons rather than petrol. He should also like to know whether coke was used as fuel on these steam wagons, and to what extent it could be used. Then, in Mr. Smart's paper, in the case of No. 2 wagon, a higher cost per mile was shown in his statement; but the total mileage covered was less than the other two wagons, and the total weight carried less. That wagon might have been used on short journeys as compared with the other two wagons. If that was so, would it not point to haulage by mechanical machines being more economical on long journeys than short?

Mr. J. Julian (Cambridge) said the papers were extremely useful, but he had taken most notice of the figures given in Mr. Smart's paper, because he had given figures which enabled them to work out the cost of doing work under other circumstances. Mr. Smart's figures were given so fully that they were able to calculate the average length of journey for the different motors. They were something very different from what they would get in a town. The first lorry made an average journey of 15 miles, and that would be going so much faster than they could travel in the towns. The motors were working at an average rate of 12 miles an hour. Those figures were not at all applicable to town work. But he was very pleased Mr. Smart had given them so many figures, as they were able to work out the cost for the shorter journeys. Each load averaged rather over 5 tons for a 5-ton lorry. Was that due to habitually slightly overloading of the lorries, or was it that no loads were carried on the return journey, and anything put on was weighed on arrival? It was hardly likely that they were able to keep up an average of over 5 tons per load. Something had been said about the average cost. They got the cost per hour and per day. He did not think either of these ways of working was altogether satisfactory. He thought they wanted the rate per day plus so much per mile. He found it worked out at about 5d. per mile.

Mr. L. Roseveare (South Shields) remarked that Mr. Elford had stated that the average speed of the loaded 3-ton Edison electric accumulator vans was 8 or 9 miles an hour. His corporation was the first to use the Edison battery motor for this work. For stopping and starting it was good, but if they were going to take the comparative speed, don't put it at 8 or 9 miles an hour. If they got the Edison vehicle

of 3 tons loaded to go at the rate of 4 miles an hour on a hill they were lucky.

Mr. A. W. WARD (Shrewsbury) said, with regard to Mr. Elford's paper, he assumed that Mr. Elford did not propose to collect the whole of the house refuse of his borough by mechanical haulage, for he noticed that he mentioned the furthermost part of the borough. He had to report on this question, and he had come to the conclusion that the only way of doing it was by horse vans, and the picking up of the full vans by motors. Mr. Higgens' paper gave the comparative cost of collection of house refuse by horse and by mechanical traction, and there was only a saving of 6 per cent. by motor vans. Did that mean that Mr. Higgens collected the whole of the refuse by motors from carts which had made the collection, as described by Mr. Elford, or did he collect from house to house by motor vans?

Mr. E. J. ELFORD, in reply, said, with reference to Mr. Higgens' remark as to training men for motor drivers, he quite agreed that to train men was generally the best system. He found that the men, when trained, got afflicted with what was called swelled head, and a man who was receiving 18s. last week and was now a qualified driver found he could do better somewhere else, and the result was that they had lost a good many men after training them. Mr. Collins raised the question of coal. He quite agreed as to the quality of coal to be used. They used nothing but the best Welsh steam coal. He had tested it for years, and he was firmly convinced that was the cheapest fuel. Mr. Cockrill raised several questions. As concerned the cost of running, Mr. Cockrill did not give them any details of the £1 4s. per day, and without details it was impossible to make comparisons. Possibly Mr. Cockrill's cost of labour was much less than his; in addition to that they did not know whether there was anything included for interest on capital. That was a point he proposed to mention in connection with Mr. Higgens' paper. He gave his cost per day, for motor only, at 7s. 5d. What struck him as being somewhat extraordinary was that he appeared to run his motor on two hundredweight of coke per day. He must say that he looked upon that as being impossible under his conditions. He did not know what the mileage was or the kinds of loads carried. Even with best Welsh coal he could not run steam motors on that amount of fuel. Then nothing was calculated for rent and depot expenses, and the overhaul, which appeared to take place every seven years after the motor had been cleared. That did not appear in the account. There were various other items which did not appear to be included. He only mentioned this in order to show how important it was, in making any comparison, to take care that all the figures were on the same basis. Mr. Gullan asked a question as to horse hire. There, again, it was important that there should be a full knowledge of local conditions before conclusions were arrived at. It might be possible to save a considerable sum by mechanical traction in one district, while in another district the result might be entirely different. He should not attempt to compete with horse haulage at 5s. per day. Then, in regard to using a trailer. A trailer could often be used with very great advantage, but in that case they had to reduce their speed. Mr. Smillie raised the question of depreciation. He preferred to take a conservative view of the life of a motor vehicle, and he thought ten years was quite long enough for his own experience, though the vehicles were looked after very well. The running cost, the cost of repairs, and the amount of delay resulting from time occupied in repairs and overhaul increased enormously after a certain length of time, and his own opinion was that it was much better to get rid of the vehicle some time before it was ready for the scrap heap, and get a new one. A question was asked about the price of petrol. That was what they had been paying for some months past. It was the best quality, and they found there was very little difference in the cash result—that was to say, taking a cheaper grade of petrol, the cost was practically the same as the higher grade, and there were disadvantages in having to store a larger bulk. He was asked the average cost per ton mile of petrol and steam driven vehicles for street watering. He was afraid he could not give that for street watering. He did not think any information of that kind, particularly for street watering, would be of any great value. Then as to the wear and tear on roads he did not take that into consideration at all. Other people used the roads with mechanically driven vehicles, and although their few vehicles might contribute to the wear and tear to some extent, he did not think that was a very important matter. The average travelling distance of water vans was 38 miles per day. That was recorded by a speedometer. Mr. Roseveare raised the question of the speed of electric vehicles. That was, in his opinion, the one weak point. With the experimental electric 'bus they had been running for from twelve to eighteen months, and they had found that they could run that fairly well in service with petrol vehicles. The average speed had worked out at about 8 or 9 miles per hour. The route was not hilly, and a short hill taken at 4 miles per hour did not make much difference on the day's work. Mr. Ward raised a question on the latter part of his paper, where he mentioned that he was using a petrol vehicle as a tractor. He thought that a suitable vehicle, and that it would pay to take all the refuse to the destructor with a petrol vehicle. The collection, he thought, must be done by horses, and then, by using the petrol vehicle as a tractor for the loaded carts, and taking them a long distance, he thought probably a very great saving would be effected. In making these remarks as to long journeys, he was not referring to the electric vehicle. It might be possible with electric vehicles to do the whole collection as well as the delivery with motors.

Mr. T. W. E. HIGGENS, in reply, remarked that one of the speakers had said it was a pity the whole of the three papers were not on the same basis. It was a pity, but it showed that there was no collusion between the parties. Mr. Elford referred to the training of motor drivers; all he could say was that of all the men they had trained they had lost only two. There were no charges for rent or for depot. So far as rent was concerned, they had this yard and the depot before they bought the motors. Its cost was no more than before; they simply put the motors in the shed where they put the horses. About £200 was spent about seven years after they got the vehicles. When the Motor Car Act was first passed the vehicles were built much lighter than they were afterwards. They found that the later vehicles did not want this money spent on them. As regarded fuel, the fuel they had always burnt was coke, which they got comparatively cheaply. Their vehicles lately had always been driven by one man. Since the introduction of motors they found there was a considerable drop in contractors' prices for horses. Mr. Cooper asked the length of the journeys. Chelsea was a very small district, but he should think the average journey would be about 2 miles there and back. Then the question was also raised about the type of vehicle. He was bound to say that those they had got did require a ladder for the dustmen to climb up to put the refuse in. If they had a low vehicle it must be a very great nuisance to persons in the streets. Then Mr. Willis asked about the drivers' wages, and whether it included overtime. They did not pay extra for overtime except under extraordinary conditions. Then someone spoke about repairs. There was contractors' maintenance, and also repairs; but if they looked at the paper they would see that the item of repairs was the exception. In nearly every case the repairs applied to the Thornycroft vehicle. The difference in oil consumption between the two vehicles was explained by the fact that one was a little leaky, and dropped oil from the tank. Then reference was made to the tractor. When they first started they used dust carts as trailers, but they got into so much trouble that they had to give up the trailer and put higher loads on the vans, and they had never regretted it. Then he was asked why they used steam wagons instead of petrol. When they started in the last century petrol wagons were not thought much of. As they started with steam, and had got this excellent contract, they had stuck to steam ever since. That was why the cost of these vehicles appeared to go down the older they were. The reason was that the vehicles had become more standardised than they were now, and it was much cheaper to maintain fifteen vehicles when they were all made to the same standard. The result was that they had the maintenance so much cheaper. He was bound to say that it had gone up since the war. He was asked if they collected all by motors or partly by horses and partly by motors. In the summer-time they collected partly by horses, except in the slack season, when they did it all with motors. Their collection was mainly by motors, and they found it paid.

Mr. F. W. SMART said, in reply to Mr. Collins' statement that only one-fifth of the number of hours were

speed on outward journeys, the only answer he could make was that the lorries were of secondary consideration; they were working for the improvement and maintenance of the roads. They did not study the lorries at all as to distance. He did not know whether Mr. Willis would like a copy of their driver's time-sheet; if he did, he would send it to him. Then he asked for the makers of the tyre. He was sorry that the two tyres they found answer their purpose so well were of German make. When the English makers knew of the faults in their tyres they at once altered them, and they had no difficulty in getting Dunlop or a Shrewsbury Challenger tyre to cover 14,000 miles, and they had never exceeded that with the Peter Union or the Continental tyre. It was only fair to say they had had a Peter Union which had not lasted a day when put on, and this had never happened to an English tyre. Mr. Willis asked as to the unloaded journeys. They were all taken together for statistics. Mr. Gullan mentioned the distance they found most economical, and asked if they could work economically for short distances. They found they could send material by motor 3 miles away, compete with horse haulage, and save 6d. per ton, which was 25 per cent of saving. A horse and cart would carry 5 tons of material at a cost of 2s. per ton per day. A motor could take 18 tons per day at a cost of 1s. 6d. per ton. Mr. Smillie said they wrote off their motors by depreciation in fourteen years. If he referred to the paper he would find the cost was written off in seven years. At the end of seven years they thought it better to sell the motor and get another. Mr. Eley asked why the cost of No. 2 lorry was higher than the other two. That lorry was sent away a distance of 9 miles from a station; the days were short, and the motor had to convey the material for short distances, and it upset the statistics as compared with the other two lorries. Mr. Julian raised a point as to whether they overloaded. He could assure the members that they never put on more than its legal weight. As the registering authority they dared not do such a thing. If a man had 5 tons 1 cwt. put on, the 1 cwt. was taken off, so that no contractor should be able to say to them, "You exceed the legal limit, though you do not allow us to do so." The loads on return journeys were weighed in; that accounted for the apparent overloading.

(To be continued.)

SOME RECENT PUBLICATIONS.*

The Law Relating to the Taxes on Land Values. By E. P. Hewitt, K.C., LL.D., assisted by Kenneth C. Raikes, Barrister-at-law. Price 7s. 6d. nett. London: Butterworth & Co.

In this work the law is presented in the form of a continuous statement, and not by way of notes to the different sections, a form which will strongly appeal to the non-legal reader. Since the very novel and complex Act of 1910 was passed it has given rise to much litigation, and the author refers to all material cases, including, in some instances, decisions by referees which do not appear in the ordinary reports. The statutes and rules are embodied in an appendix. The work is a clear and concise statement of the law, which, although intended primarily for the legal profession, is also well suited to the requirements of those surveyors whose duties require some knowledge of the subject.

Beautifying City Squares and Streets.—Mr. J. A. [illegible], Director of Liverpool Parks, says the *Liverpool Post*, recently accepted, from the Parks and Gardens Committee, the congenial task of brightening the Liverpool squares and streets with foliage growing in tubs. By adding flowers to foliage and varying the green shrubs with others of golden privet, he is enhancing the effects. The Exchange Flags recently assumed a new aspect when a fine assortment of sweet peas, growing and almost in full flower, was placed between shrubs of green and gold. By a happy selection the statue of Nelson was the first to be surrounded with the foliage and flowers fresh from the nurseries. No one could cross the famous quadrangle without pausing to admire. Many cultivators of sweet peas expressed a wish to see the specimens labelled, so that their own gardens could be further enriched.

* Any of the publications reviewed or noticed in this Journal, will be forwarded by the St. Bride's Press, Ltd., 13, Bride Street, E.C., on receipt of published price, plus 1 stamp in the case of new books.

HORSE TRACTION IN RELATION TO CLEANSING WORK.*

By W. H. Hamblett,
Cleansing Superintendent, Salford.

In this, as in other matters, I would say, Let every man be fully persuaded in his own mind, and let that persuasion be based simply on the local conditions in requirements and finance which govern his own town.

In order that we might have before us a tabulation of experiences and opinions of men who are engaged in cleansing work in many of our large cities and towns, I sent out a series of questions—bearing on the various phases of cleansing work—to about thirty authorities, varying, in their geographical positions, from the North of Scotland right away down to the South of England.

The following may be taken as a summary of the answers given:—

Motor traction as against horse traction in relation to street cleansing work: In favour, six; against, eleven; undecided, six.

Motor traction as against horse traction in relation to street watering work: In favour, thirteen; against, two; undecided, eight.

Motor traction as against horse traction in relation to machine sweeping work: In favour, twelve; against, two; undecided, nine.

Motor traction as against horse traction in relation to domestic cleansing work: In favour, eight; against, nine; undecided, six.

Motor traction as against horse traction in relation to clinker removal work: In favour, six; against, five; undecided, twelve.

The Horse and Street Cleansing Work.

It is evident from these returns that there is still a great amount of indecision on the question of employment of motors in general street cleansing work. It is also manifest that there is lacking a strong and definite lead or consensus of opinion that the horse could be altogether disposed of in relation to street cleansing work. It must be apparent that, while motors for street sweeping machines and street watering may be efficient and economical in these particular sections of street cleansing work, the horse may still be found useful and economical in "picking-up work." One cannot imagine a claim being made that it is advisable to displace the horse in this form of work. The work is so slow—ever stopping to pick up ruck after ruck—that to employ a costly motor for picking-up work seems to be positively extravagant.

Though many commendable attempts have been made to put on the market street sweeping machines which would automatically pick up the sweepings, I have not yet seen a machine which was in all points so satisfactory as to enable me to recommend a purchase. Authorities and officials having charge of street cleansing work would, I am sure, give a hearty welcome to help in this direction. In my opinion, until the desired machine comes along for doing this combined work, you cannot do better than stick to the horse for that particular work of "picking up."

In street watering there may be many advantages in the employment of motors.

During the long drought of a few weeks ago I personally realised the absolute inadequacy of the horse for street watering, because of the fact that the work of the horse could not be so continuous as the motor, and therefore, in relying upon the horse, one fell considerably short in the matter of meeting the necessities of such a special time.

In street sweeping one is also bound to admit that, on account of the "non-stop" principle involved in this section of cleansing work, the necessities of the work are best met by the use of motors. As I have no practical working experience under this head, I may be excused for saying that I am yet waiting to be convinced that it is economical to have a separate motor machine for street sweeping exclusively, and another motor exclusively for street watering.

Domestic Refuse Collection.

When we come to the question of the use of the motor wagon in the collection of domestic refuse, I fail to see how by this means alone we could ever think of securing either efficiency or economy in the

* From a paper read at the annual meeting of the Institute of Cleansing Superintendents.

The Surveyor
And Municipal and County Engineer

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majority of our large towns, where we have long rows of houses, with back passages through which the motor cannot be taken, and where from each back yard the ashes have to be collected and brought to the end of the passage in order to be tipped in the motor. It surely cannot be regarded as what we might call a "paying game" to keep a motor, costing hundreds of pounds, employed in a work where the process of loading is so very slow.

I believe that it is an admitted fact that motor traction—in business generally—is not regarded as being efficient and economical unless you have two things assured—first, quick loading and distance running. It is always urged in connection with this question that "point-to-point" and "non-stop" traffic is the only way to secure all the advantages required in the displacement of the horse by motors. In the collection of domestic refuse on ordinary lines, in most towns, we do not get these two essentials.

In submitting a paper of this kind I am not so foolish or short-sighted as to try and prove a case for horse traction to the extent of trying to show that the motor in cleansing work has no place whatever, and that the horse and nothing but the horse is the right traction power to be employed. As I have already tried to show, I believe the horse to be a great necessity in some sections of cleansing work, and, if you want my opinion frankly on the matter, I think the greatest possible success, both in the matter of efficiency and economy, is to be found in officials endeavouring, in certain towns, to find that happy medium which I believe is to be found in the proper use of both horses and motors. . . .

CLINKER REMOVAL.

In this section of cleansing work we again come into contact with a phase of the work when it is absolutely useless to depart from horse traction unless special provision is made for speedy loading and unloading. In our own town, although the distance between destructor and tip was 2½ miles, motor haulage had to be given up, as horse traction was found more economical.

My claim for horse traction is that it cannot be discarded in every section of cleansing work. I think that it cannot be satisfactorily demonstrated that the horse is no longer required. I have often heard it said that the motor has come to stay. This is no doubt true in relation to many forms of work, but some phases of cleansing work are so far apart from the traction question generally, that I believe that the horse is with us to stop, at least until some changes are made in motor traction of which at the present time we have not even a dim forecast.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Has any practical trial on a fairly large scale yet been made of the Crombie sewage purification process, a small installation of which was on view at the recent exhibition of road appliances at the Horticultural Hall? If this system will achieve all that was claimed for it by the demonstrator at the stall, will it not again revolutionise the present bacterial methods of sewage treatment which are now in vogue?

* * * *

Apropos of sewage treatment, is it not rather to be regretted that Mr. Wakeford, in his excellent paper "Brief Notes of Experiments in Sewage Purification by Forced Aëration," did not tell us more about the cost of the installation of such a system and its subsequent operation? Do not most of us agree that sewage purification by means of aëration, or the action of oxygen, is on the right lines, but is it not a question that has yet to be answered how this is to be effected economically without creating a smell, and a possible addition to the sludge difficulty?

* * * *

Which was the most practical and useful paper laid before the recent road conference at the Horticultural Hall? Without in any way detracting from the other excellent papers, does it not strike one that, so far as road engineers are concerned, the one by Messrs. Sheldon and Lyddon, on the "Use of Tar, Pitch, and Bitumen in the Construction of Roads," was of extreme value as giving the result of the adoption of various methods of surface construction? Have not the long lengths of road thus treated been of greater use for educative purposes than those of the "Sidcup" trials, where only short lengths were treated, and many of the processes there tried were hopeless from the start?

* * * *

When shall we arrive at the *Ultima Thule* of road-surface construction, when a surface capable of resisting any ordinary traffic can be constructed at about 1s. a square yard? Is this unachievable, or shall we some day find the very substance for which we have all been seeking? Or is this a mere *ignis fatuus*?

* * * *

With regard to the recent legal question as to whether a cinematograph show is within the meaning of the words "healthful recreation or exercise," are there not still a large number of able-bodied young men who prefer this form of "recreation and exercise" to that of drilling, or the open-air life of the trenches? When we read letters from the Front like those given in last week's issue of THE SURVEYOR under the heading of "Details from the Dardanelles," should not such letters make every young man in the country say: "Cinematograph shows are all very well in times of peace, but give me a rifle and let me do some real man's work"?

* * * *

Is it not a source of satisfaction that these "Things One Would Like to Know" frequently elicit valuable information? For instance, is it not interesting to hear that Mr. Lovegrove was not the first surveyor to construct good road surfaces with refuse destructor clinker, but that Mr. Roberts, the borough surveyor of Worthing, constructed similar roads ten years ago? Will Mr. Roberts let us know his exact methods, and whether the surface was constructed with a finishing carpet of very fine materials, or were his roads merely ordinary tar-macadam, using clinker instead of stone?

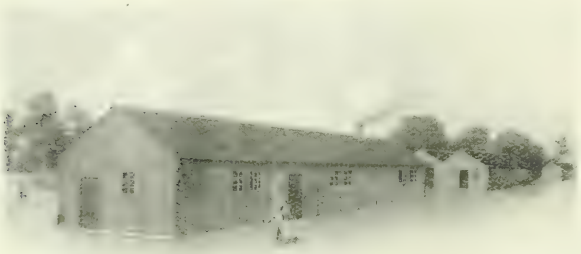
* * * *

Are not the accounts of the London County Council's tramway undertaking rather depressing reading for the ratepayers? Have not the council yet realised that, except for very long distances, the tramcar is an almost obsolete vehicle, and can never become a kerb to kerb or door to door means of conveyance, and that the sooner this is realised and the non-paying routes shut down and scrapped, the less will be the ultimate loss to the ratepayers?

Housing at West Ham.—A recently submitted report by the borough treasurer shows that the total loss on the West Ham municipal dwellings for the year ended March 31st last was £888, as compared with £1,468 in the previous twelve months. The total loss up to date is £18,332, but beyond this there is a loss amounting to £9,971 on the sites bought for the dwellings.

SECTIONAL STEEL BUILDINGS.

A type of sectional steel building which should prove of inestimable service at the present time has been brought to our notice by the Wellsex Company, Limited, Salisbury House, London-wall, E.C. From the particulars with which we have been supplied the system would appear to be an ideal one in cases where premises have to be made without loss of time, for workmen's dwellings, military shelters, hospitals or stores. The rapidity with which the buildings can be erected is a great point in their favour. Being built in standard sections made to bolt together, they can be constructed speedily by unskilled labour, and can be



Wellsex Sectional Steel Buildings

dismantled as quickly. They are claimed to be indestructible, and weather, vermin and rot proof.

All sections for sides of buildings are made 9 ft. by 5 ft., allowing for a height of 9 ft. to the eaves, and the length and width may be any multiple of 5 ft.

An important feature of this form of construction is that an existing building can at any time be added to, either in length or breadth, so that, if a few dozen sections of various types are stocked, a building of almost any size can be made up.

Manchester Gas Profits.—The annual report of the gas department of Manchester Corporation shows a nett profit on the year of £51,159, as against £81,126 in the previous year. The gas sold was 5,881,103,000 cubic feet, an increase of 1·90 per cent compared with the previous year.

Poplar Electricity Department.—According to the annual report issued by the borough electrical engineer Mr. J. Horace Bowden, M.Inst.C.E., the output of the Poplar electricity department has increased from 2,000,000 units to 17,000,000, and the gross profit during the past year, which was £37,484, is an increase on that of the previous twelve months of £8,371.

The Lady Ratepayer's Fancied Privilege.—The report of the surveyor, Mr. J. Twemlow, presented at the recent meeting of the Ashbourne Rural District Council, contained a paragraph which caused amusement. It appeared from this that a woman at Yeaveley had taken some material from the roadside to repair her garden path, and when spoken to about it she replied that as a ratepayer she thought she was entitled to her "little bit of stone." The surveyor was instructed to exact payment.

The Disposal of House Refuse.—The Tunbridge Wells Works Committee recently reported the receipt of a circular letter from the Local Government Board on the subject of storing, collecting, and disposing of refuse, and urging the local authorities to endeavour to make every necessary improvement before the hot weather sets in. Alderman Silcock asked if this was not directly contrary to the circular recently issued by the council to the effect that refuse would not be collected so frequently in future. He thought the last thing they should be economical in was the health of the town. Councillor Kelsey said it was a very small matter for the people to burn a good deal of their refuse, but Councillor Chapman pointed out that many people had no backyards to burn rubbish in and no fire in summer to burn it. He thought the council's letter was a ridiculous one. The town clerk remarked that since the issue of the circular there had been much less refuse to collect, and an improvement in its quality.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Wednesbury T.C. (July 2nd. Mr. W. O. E. Meade-King). £1,350 on account of the extensions of the municipal offices and public baths, and the erection of new education offices.—The town clerk, Mr. T. Jones, stated that £9,450 had been previously sanctioned, and that the work was completed in October, 1913. The present loan was required to defray "extras" which were incurred while the contract was being carried out. The application was unopposed.

West Hartlepool T.C. (July 1st. Mr. Raymond Unwin). This was an inquiry into an application by the corporation for authority to prepare a town planning scheme with reference to an area situate partly within the borough and partly within the rural district of Hartlepool.—The borough engineer, Mr. N. F. Dennis, stated that the proposed area comprised a total of 5,332 acres. The southern area at the present moment was all agricultural land. The present position was quite unique for a populous district. He did not think they would find another district so devoid of road communication as this particular one. One of the objects was to lay down arterial roads, and there was a great future for the area when it was so developed. By a road from the Tees, Middlesbrough, Port Clarence, Stockton, and West Hartlepool could be linked up. One of the advantages of the road would be to reduce the distance between Middlesbrough and West Hartlepool from 12½ miles to 5½ miles. The scheme would be in the interests of estate owners as well as of the public. Provision was to be made for open spaces.

APPLICATIONS FOR LOANS.

Aldershot U.D.C.—£906 for the erection of houses.

Dublin T.C.—£61,425 for housing schemes.

Guildford T.C.—£10,500 for a housing scheme.

Luton T.C.—£2,000 for pumping plant.

Macclesfield T.C.—£3,300 for water supply purposes.

Ruislip-Northwood U.D.C.—£5,365 for a housing scheme.

Reigate T.C.—£1,000 for the electricity undertaking, and £9,200 for paving works.

Wantage R.D.C.—£1,850 for works of water supply.

LOANS SANCTIONED.

Brixham U.D.C.—£300 for the purchase of a site for the isolation hospital, to be repaid in sixty years.

Chelmsford T.C.—£1,500 for new water-pumping plant.

Driffield R.D.C.—£180 for works of water supply.

Goole U.D.C.—£5,014 for works of sewerage.

Maidstone T.C.—£4,800 for new electrical plant.

Rowley Regis U.D.C.—£335 for sewerage works.

FORTHCOMING INQUIRIES.

JULY.	£
13.—**Bridlington.** For the provision of a refuse destructor (Mr. H. Shelford Bidwell)	—
13.—**Haverfordwest.** For the purposes of the gas undertaking (Mr. F. H. Tulloch)	1,350
13.—**Southampton.** For the provision of a water tower (Mr. A. W. Brightmore)	14,000
13.—**Tredegar.** For the purpose of a housing scheme (Mr. H. A. Chapman)	16,488
14.—**Barnsley.** For the purposes of the electricity undertaking (Mr. H. Shelford Bidwell)	21,850
15.—**Spilsby.** For the purposes of a housing scheme (Mr. Edward Leonard)... ...	—

Preparation and Laying of Tar-Macadam on Roads in Bedford.*

By N. GREENSHIELDS, Assoc.M.Inst.C.E., Borough Engineer and Surveyor of Bedford.

In 1907 and 1908 several experimental lengths of tar-macadam were laid down on the carriageways in Harpur-row, Alexandra-road and portions of Goodman's-road, Bedford, the material consisting of tarred granite, tarred slag, and also clean granite and slag treated in with tar and several patent preparations.

As a result of these experiments the author came to the conclusion that it was an unnecessary expense to use granite tar-macadam in Bedford, and considerable difficulty was also experienced in getting the granite macadam to bind down quickly for the reception of traffic. The grouting-in with tar, &c., also did not give satisfactory results.

The material found from experience to be the most suitable was ironstone slag tar-macadam, and he therefore recommended the town council to adopt this, and it has given excellent results in Bedford, both from the standpoint of economy and its suitability to withstand the wear and tear of traffic.

Experiments were also carried out with ordinary tar, and several patent preparations of tar for mixing with the ironstone slag, and ordinary gasworks tar was found to give satisfactory results provided it was carefully boiled and a small quantity of pitch added when required.

Most of the slag tar-macadam used in Bedford is mixed by hand in the corporation depot at Newnham, and from practical experience the hand-mixed material has been found to be far stronger and infinitely better suited for use than machine-mixed material bought ready for use. Any tar-macadam required beyond and above the quantities mixed at the depot is purchased from outside contractors.

All clean ironstone slag is sheeted on the railway wagons and on the carts to keep it as dry as possible, and the material is afterwards dried and warmed upon hot plates before being mixed.

The whole of the hand-mixed material is turned over three times in the mixing, the quantity of tar used varying from about 8½ to 21 gallons per ton of material mixed, the variation being due to the size, &c., of the material treated. All tar is carefully boiled before use.

The hand-mixed slag tar-macadam comes out at from 6½d. to 1s. 7½d. per ton cheaper than it can be bought ready mixed.

The cost of mixing 441½ tons of 2-in. and 1½-in. tar-macadam was 11s. 7d. per ton. The details of cost are as follows—viz.:—

	£	s.	d.
Dry slag, 422 tons	127	14	5
Tar, 3,570 gallons	22	6	3
Pitch, 15 lb.	0	0	8
Ganger, 500 hours ...	11	11	6
Labour (manual), 2,315 hours	42	6	6
Sheeting on rail, &c.	4	10	0
Carting slag (rail to depot), 52 days ...	18	4	0
Carting tar, 8 days	2	16	0
Paraffin oil, 8 gallons	0	5	0
Coke, 3 tons 6 cwt	2	9	6
Coal, 4 cwt	0	3	2
Cotton waste, 23 lb.	0	4	0
Repairs to plant	0	7	0
	£232	18	0
Add 10 per cent. for establishment charges, use of tools, &c.	23	5	10
Total ...	£256	3	10

All the tar-macadam laid in Bedford has given satisfactory results, but very great care has always been exercised in the selection and preparation of the material and the laying of same on the roads, special attention being given to the strengthening of the foundations where necessary, and also in arranging the levels and cross-falls.

Some of the carriageways in the principal streets in Bedford were laid with slag tar-macadam in June, 1909, and have required very little repair since that time, although subjected to incessant traffic, including steam lorries, and in many cases to the wear and tear of a constant service of motor omnibuses, which quickly cut the ordinary water-bound roads to pieces.

* Paper presented at the annual general meeting of the Institution of Municipal and County Engineers.

The work of laying tar-macadam in Bedford has been going on steadily since 1908, and at the present time there are about 7 miles of carriageways in the principal streets and roads laid with tar-macadam.

The cost of laying tar-macadam on the carriageways, as per short specification given, is 3s. per square yard, including all materials, labour, steam rolling, &c. Before 1912 the work could be executed for 2s. 9d. per square yard, but, owing to the rise in price of materials, increased cost of team and manual labour, the price has advanced 3d. per square yard.

SHORT SPECIFICATION OF WORK OF LAYING TAR-MACADAM.

The existing macadam on the carriageway is first removed until the surfaces of the foundations are 4in. below and parallel to the finished levels of the new surfaces which are arranged with cross-falls varying from 1 in 24 to 1 in 32.

After the existing foundations have been thoroughly steam rolled and prepared, a layer of prepared slag tar-macadam of 2-in. to 2½-in. gauge is laid down and consolidated with steam rollers until the surfaces have been brought to an even contour, and there is a finished thickness of 2½in. On the bottom layer of slag tar-macadam a top layer of prepared slag tar-macadam of 1¼-in. to 1½-in. gauge is laid, and consolidated with steam rollers until it has a finished thickness of 2 in.

A layer of clean slag grit is then spread on the finished surfaces of the carriageways.

The surfaces are finally tar-painted and covered with slag grit.

Loans for tar-macadam works have been sanctioned by the Local Government Board as follows—viz.:—

1910	£3,973
1912	3,811
1913	5,840
Total	£13,624

The repayment of interest and principal on each loan has been spread over a term of seven years. The work in connection with the 1913 loan was commenced last season, but no new work will be taken in hand this year owing to the war.

TAR-PAINTING OF CARRIAGEWAYS.

A total length of 9½ miles was tar-painted in the borough during 1913, the cost coming out at from ¾d. to 1d. per square yard, according to the kind of roads treated. The work is done by two horse-drawn machines.

GRANITE MACADAM ROADS.

During the past three years the author has been experimenting with different methods of binding dry granite when resurfacing carriageways in the suburbs so as to do away with the old-fashioned water-bound roads in the town as far as practicable, and he has found that, by using ¾-in. gauge tarred slag sprinkled on the top of a layer of clean granite after the granite has been laid in position on the road, but before the granite has been steam rolled, and then, after rolling the granite, using a small quantity of ½-in. gauge tarred slag and then rolled again as required, and finally finishing off with a sprinkling of ¼-in. granite chippings, he has been able to bind the granite down successfully without using any other binding material, and turn out some excellent granite roads that will stand the traffic of a main road, including steam lorries and a service of motor omnibuses. He has also found that when the surface water-painted there was a saving of nearly 50 per cent. on tar as compared with tar-painting an ordinary water-bound road. The cost of the last road resurfaced in this manner, comprising an area of 5,599 sq. yds., including all labour, materials and tar-painting, comes out at slightly less than 1s. 10d. per square yard.

The author is of opinion that no hard-and-fast rules can be laid down for road making that will be applicable to all roads and districts, but that what is required is for each engineer or road surveyor to carry out his own experiments to find out what materials and methods of construction are most suitable for use on the roads under his charge.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The following books have been chosen in respect of the premium for June, and they have been duly forwarded to the recipients:—

Mr. M. T. Roberts, of Rhyl, has selected "The Geology of Water Supply," by H. B. Woodward (Arnold), and "Electricity," by H. M. Hobart (Constable); and

Mr. B. Knight, of Newport, has selected "The Strength of Materials," by Ewart S. Andrews (Chapman & Hall).

REPLIES TO QUESTIONS.

487. Structures.—Find, graphically or analytically, the maximum deflection in a steel lattice girder of the N type, supported at each end, under a load of W tons applied on the bottom boom at a distance of 24 ft. from one support. Span of girder, 72 ft.; six 12-ft. bays; depth of girder 10 ft. Take safe intensity of stress in the members as 5 tons per square inch, and Young's modulus E=13,000 tons per square inch. There is no counter-bracing. Neglect the weight of the girder itself. (B. K., *Newport.*)

The analytical solution is as follows:—

Let L = the original length of any member of the truss

" l = change in length of that member when the load is placed upon the structure

" S = intensity of stress in member

" E = modulus of elasticity of the material

Now for stresses below the elastic limit—

Stress = strain × modulus

i.e., $S = \frac{l}{L} \times E$

or $l = \frac{LS}{E}$ (same units to be used throughout).

Let W be the load applied gradually to the girder. The structure is deflected, changes in length occurring in the different members of the frame, and a certain amount of internal work is done. For equilibrium this internal work must equal the external work, which latter is

$\frac{1}{2}$ DW

where D is the deflection (measured in the proper units) of the point of application of W.

The work done in straining any member of the structure is equal to half the product of the stress in the member and the change in length, and if F represents the total stress in the member, then—

Work done in straining any member = $\frac{1}{2}$ Fl

" " " all members = $\Sigma \frac{1}{2}$ Fl = internal work done

$= \Sigma \frac{1}{2} \frac{FLs}{E}$

(by substitution from above)

Equating the external work to the internal work we get:-

$\frac{1}{2}$ DW = $\Sigma \frac{1}{2} \frac{FLs}{E}$

i.e., $D = \frac{1}{WE} \Sigma FLs$

where D is the deflection at the point of the application of W, and if the weight of the girder itself is neglected, then D is the maximum deflection.

We now require to determine the value of FLs for each member of the frame, and before this can be done we must find the reactions.

Referring to Fig. No. 1, take moments about the right support and we get—

(Reaction of left support) × 12 × 6 − W × 12 × 4 = 0

i.e., Reaction at left support = $\frac{2}{3}$ W

∴ " right " = $\frac{1}{3}$ W

We can determine the chord stresses by the method of sections, the rule being—

Draw a section cutting three members of the frame.

To find the stress in one of these members, take moments about the joint where the other remaining two members intersect. The members cut by the imaginary section are now regarded as forces acting in a direction away from the section. When taking moments consider only the forces on one side of the section.

For example—to find the stress in PO

Take an imaginary section represented by the broken line XX in figure.

Take moments about C.

Then (stress in PO) ·10 = $\frac{2}{3}$ W ·12

∴ stress in PO = $\frac{4}{5}$ W.

It should be noted, when determining the chord stresses of a N truss, that the stresses in those chord members

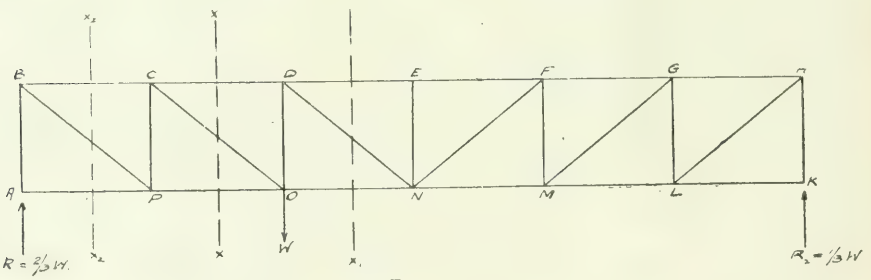


Fig. 1.

which are not separated from one another by a diagonal are numerically the same.

That is, stress in PO (tension) = stress in BC (compression).

We need therefore only determine the chord stresses in PO, ON, NM, ML, and DE. Stresses in AP and LK are zero.

To find stress in ON—take an imaginary section as represented by broken line X_1X_1, take moments about D.

Then (stress in ON) ·10 = $\frac{2}{3}$ W ·24

Stress in ON = $\frac{8}{5}$ W.

If the stress is positive then the member is subject to tension, if the stress is negative then the member is subject to compression.

The stresses in the other chord members are determined in a similar manner.

Web Members.

(1) Diagonals.—For trusses with horizontal chords the stress in any web member is equal to the product of the vertical shear and the secant of the angle which the member makes with the vertical. Let θ be this angle, then in this question sec $\theta = \frac{\sqrt{10^2 + 12^2}}{10} = 1{\cdot}562$.

Stress in BP (B.P.)

Take an imaginary section cutting BO as represented by the broken line X_2X_2

Vertical shear at this section = $\frac{2}{3}$ W

∴ Stress in BO = $\frac{2}{3}$ W × 1·562

= 1·04

Stress in C.O. = Stress in BP for the vertical shear at a section cutting CO is the same as above.

Stress in DN.

The vertical shear at a section cutting DN is $\frac{1}{2}$W, and so stress in DN = $\frac{1}{2}$W × 1·562

= ·52W.

The stress in other web members is found in a similar manner.

2° Vertical Members. If we pass a curved section as shown at the joint D in figure, we see that for equilibrium the stress in the vertical must be equal to the vertical component of the stress in the diagonal, so that

Stress in DO = vertical component of stress in DN.

$$\text{But } \frac{\text{Vertical component of stress in DN}}{\text{Stress in DN}} = \frac{10}{15{\cdot}62}$$

$$\therefore \text{Vertical component of stress in DN} = \frac{10 \times {\cdot}52\ \text{W}}{15{\cdot}62}$$

$$= {\cdot}33\ \text{W}.$$

Similarly,

Stress in the vertical PC is equal to the vertical component of the stress in the diagonal CO :

$$i.e., \text{Stress in P.C.} = \frac{10 \times 1{\cdot}04\ \text{W}}{15{\cdot}62}$$

$$= {\cdot}66\ \text{W}$$

The stresses in the remaining verticals can be found in the same way. It should be noted that the stress in LN is zero.

Table of all the stresses is given below, together with the value of the term FLs for each member :—

Member.	Stress (F).	Length (L).	Value of FL.
Chords—			
BC	·8 W	12 feet	48·0 W
PO	·8 W	12 ,,	48·0 W
CD	1·6 W	12 ,,	96·0 W
ON	1·6 W	12 ,,	96·0 W
DE	1·2 W	12 ,,	72·0 W
EF	1·2 W	12 ,,	72·0 W
FG	·8 W	12 ,,	48·0 W
NM	·8 W	12 ,,	48·0 W
GH	·4 W	12 ,,	24·0 W
ML	·4 W	12 ,,	24·0 W
LK	zero	12 ,,	zero
AP	zero	12 ,,	zero
Diagonals—			
BP	1·04 W	15·62 ,,	81·20 W
CO	1·04 W	15·62 ,,	81·20 W
DN	·52 W	15·62 ,,	40·60 W
NF	·52 W	15·62 ,,	40·60 W
MG	·52 W	15·62 ,,	40·60 W
LH	·52 W	15·62 ,,	40·60 W
Verticals—			
AB	·66 W	10 ,,	33·0 W
PC	·66 W	10 ,,	33·0 W
OD	·33 W	10 ,,	16·5 W
NE	zero	10 ,,	zero
MF	·33 W	10 ,,	16·5 W
LG	·33 W	10 ,,	16·5 W
KH	·33 W	10 ,,	16·5 W
		Total...	1032·8 W

From the table

$$\Sigma\ \text{FLs} = 1032{\cdot}8\ \text{W (ton feet units)}$$

$$= 12396\ \text{W in ton inch units.}$$

By substitution in the deflection formula we get

$$\text{Deflection} = \frac{12396}{13000}\ \text{inches}$$

$$= {\cdot}95 \text{ or } 1 \text{ in. approximately.}$$

(M. T. R., *Rhyl.*)

489. Road Making.—What is the best material from which to make paving setts for use in a carriage-way of steep gradients? Give reasons.

The choice of material for paving setts is more or less limited to the following classes of rocks—(1) Granite, (2) syenite, (3) basalt, (4) whinstone or trap rock. While none of these are ideal material for setts, they have each properties to recommend them. The chief considerations involved in selecting materials for making setts are (*a*) durability, (*b*) foothold for horse traffic, (*c*) cost. Granite is a mineral aggregate composed of quartz, felspar, more or less and of a rather coarse crystalline texture. As the quartz is practically imperishable, the wearing qualities of the granite depend on the nature of the felspar present. Granting this to be of good quality, granite forms the best material from which setts are made. It possesses merits of durability without excess of brittleness, and under normal conditions of traffic and weather remains rough even after considerable wear. Aberdeen granite, though not so hard or durable as Guernsey or Mountsorrel granite, is particularly suitable for gradients, maintaining as it does the tendency to remain rough and uneven. Granite quarries are found all over the country, and in consequence setts can be obtained at a moderate price, without undue cost of transport. Syenite is of practically the same composition as granite, only that it is holo-crystalline in texture and is generally darker in colour. It is tougher than granite, and has a tendency to become smooth and slippery under wear. It is much less abundantly found in Nature, and is consequently more expensive. Basalt is another igneous rock of hemi-crystalline texture, composed of felspar, hornblende or augite and olivine, and occurs in nature as dykes or sheets penetrating or lying between older rocks. It is very liable to decompose and weathers badly. It is dark in colour and wears uniformly and is very sanitary, but it affords poor foothold for horses, unless it is laid with very wide joints. It is not so durable as granite or syenite, but it is less noisy. Whinstone or trap rock is metamorphosed sedimentary rock, generally found flanking outcrops of igneous rocks. Setts of this material are largely used in provincial towns where traffic is not excessive, and pavements made from it, although they wear much more quickly than granite, invariably remain rough and do not become slippery in wet weather. Local circumstances very often influence the kind of stone to be used for paving material, inasmuch as the local stone, though not so suitable for the purpose, on account of its cheapness, outweighs all other considerations. No matter what material is selected, great care and judgment should be exercised that only sound material of uniform texture is converted into setts. For pitched pavements on steep gradients the size of the setts and the nature of the joints are of importance. It is advisable that the setts should not be too large, so as to reduce as far as possible the distance of slipping before being stopped by a joint. The size most used at present is 4 in. × 4 in. × 6 in. deep laid with a bituminous joint of suitable width. (J. G. W., *Dumfriesshire.*)

QUESTIONS.

This week answers are invited to the following questions :—

490. Hydraulics.—Find the ratio which must exist between the breadth and depth of water flowing in an open channel of rectangular cross-section, in order that the velocity of flow may be at its maximum. (N. W. K., *Bury St. Edmunds.*)

491. Books on Bridge Design.—Please give the name of a thoroughly practical book or books on the design of modern highway bridges. The book or books required must deal with the practical design rather than an abundance of theoretical calculation, and must be up to date. ("Tico.")

492. Hydraulics: Adjoining Locks.—There are two locks side by side. The differential head of water is 11 ft., and the area of larger lock is 200 ft. by 40 ft., and that of the smaller is 120 ft. by 25 ft. The depth of water in cills when the lock is empty is 15 ft. The locks are connected by a sluice-way placed at the bottom of the lock, having an opening of 16 sq. ft. Neglecting friction and assuming the water to fall freely, calculate how long it will take to establish equilibrium with the sluice fully open. What allowances would have to be made in practice? (J. G. W., *Dumfriesshire.*)

493. Theory of Beams.—A girder is continuous over two spans of 20 ft. and 15 ft. respectively. What are the relative reactions of the three supports? (Inquirer.)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

Public Baths and Cinematographs.—The Lewisham Baths Committee have concurred in the action of the Shoreditch Borough Council in the matter of the recent decision of the Court of Appeal in the case of the Hoxton Cinema Company, restraining the borough council from letting their public baths for the purpose of cinematograph or other entertainments during the winter months. The Shoreditch Council have resolved to approach the London County Council with a view to that authority including in their next General Powers Bill a clause to amend the Baths and Wash-houses Act, removing this restriction.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Nottingham; housing and town planning—Dunfermline, Shoeburyness, West Bromwich; roads and materials—Ayrshire, Shoreham, Wilton; sewerage and sewage disposal—Midsomer; water, gas and electricity—Blackburn, Erith. Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Aldershot U.D.C.—The surveyor, Mr. F. C. Uren, has received instructions to prepare plans for an additional block at the isolation hospital.

Brightlingsea U.D.C.—The surveyor, Mr. H. Lord, has been instructed to prepare a plan and estimate of a temporary lavatory on the council's property in Victoria-place.

Edinburgh T.C.—The final accounts in connection with the erection of the Usher Hall, which was a gift to the city, have been submitted to a corporation committee. The cost of the site, building, and furnishings amounts to £144,984. The estimated money in hand from capital and interest is £134,486. Thus there is an excess of expenditure of about £10,498.

Manchester T.C.—Plans have been approved for a sub-station and pump-house in connection with the electricity undertaking.

Nottingham T.C.—The Public Baths Committee on Monday were authorised to acquire a site at New Basford for the erection of public baths.

Winchester T.C.—A scheme has been approved for the erection, after the war, of a new bridge at Tunnel-mead, at an estimated cost of £1,150.

HOUSING AND TOWN PLANNING.

Colne T.C.—The borough surveyor, Mr. T. H. Hartley, is to visit a number of towns and urban areas where town planning schemes have been approved.

Dudley T.C.—Following a report on the subject by the borough surveyor, Mr. J. Gamage, it has been decided to purchase 50 acres for a housing scheme, at a cost of £250 per acre.

Dunfermline T.C.—It is announced that the proposed town planning scheme has been completed, and will shortly be presented to the Local Government Board for approval.

Foleshill R.D.C.—A contract has been entered into for the erection of sixty workmen's dwellings—thirty in Bedworth and thirty in Foleshill.

Hemsworth R.D.C.—A letter has been received from the Local Government Board on the subject of the housing schemes generally, suggesting that the council should prepare and submit their schemes to the board for consideration, together with formal applications for sanction to the estimated amounts required, when the board could hold local inquiries. It was further stated that the plans relative to the provision of working-class dwellings in the township of Brierley appear to be generally such as the board could approve, subject to certain modifications, and the council should now apply for sanction to loans for the amounts estimated to be required for the purchase of the land and for the building scheme, so that the local inquiry can be held. The council resolved that the various schemes in hand be proceeded with as rapidly as possible, so that the necessary local inquiries can be held.

Scarborough R.D.C.—It has been decided to build workmen's cottages on a site at Seamer.

Shoeburyness U.D.C.—The council are considering in committee plans for the erection in Wakering-road of six blocks of two houses each, at £450 a block.

Sidmouth U.D.C.—A sub-committee has been appointed to meet property owners individually and confer with them as to the best method for setting out the land under a town planning scheme.

Wednesbury T.C.—The town council have received an intimation that the Local Government Board do not think they would be justified at present in sanctioning the application by the corporation for power to borrow £5,340 for the erection of twenty-four artisan dwelling-houses. The decision places the corporation in a somewhat awkward position, as, on the assumption that the scheme would be sanctioned, not only has the land been acquired, but a number of the houses have actually been built.

West Bromwich T.C.—The Sanitary Committee report that under the Housing of the Working Classes Act a housing scheme has to be undertaken on account of the demolition of houses in carrying out the Mayer's Green improvement scheme. The Local Government Board required the erection of twenty houses on a site or sites to be approved by them, and according to plans to be approved by them. The scheme is to be carried out within twelve months of its approval by the board, but, in view of the restrictions which the Local Government Board are placing on loans by local authorities, it is very doubtful whether the board would require the scheme to be executed within the time named. A plot of land situate in Hardware-street is recommended to be used for the erection of twelve of the houses, and the corporation are empowered to acquire other land, and to raise money. The estimates for the erection of twelve houses show that the cost of the land would be £2,840, and, putting the weekly rental of each house at 5s., it is estimated there would be a nett yearly deficiency of £50, which would be provided out of the rates. The committee recommended the council to pass a resolution undertaking the scheme.

REFUSE COLLECTION AND DISPOSAL.

East Grinstead U.D.C.—It has been agreed to remove trade refuse at the rate of 1s. per load, with a minimum charge of 6d.

Lewisham B.C.—The Works and Highways Committee recommend the acceptance of the tender of the Eagle Engineering Company, Limited, at £55 each, for the supply of six dust vans.

Shoeburyness U.D.C.—A house-to-house inspection is being carried out with a view to the substitution of movable dustbins for fixed ashpits.

ROADS AND MATERIALS.

Ashburton U.D.C.—For the supply of stones for the main roads the tenders of Mr. A. Satterly, at 3s. 1d. and 3s. 2d. for the eastern and western sections respectively, have been accepted. The tender of Devon Trading Company for cement, at 51s. per ton, has also been accepted.

Ayrshire C.C.—A report submitted by the road surveyor, Mr. Allan Stevenson, to the Ayr District Committee of the county council on Tuesday stated that the estimated expenditure for the maintenance of the roads in the Ayr district of the county for the ensuing year was £12,936.

Brandon U.D.C.—The council have decided to forward to the Road Board the estimate of the surveyor, Mr. G. G. Donkin, with respect to the repair of the damage caused to local roads by military traffic.

Broadstairs U.D.C.—The surveyor, Mr. H. Hurd, has prepared plans and specifications for making up and sewering Afghan-road, at a rate of 18s. per lineal foot for road making, and 4s. 5d. per lineal foot frontage for sewering, the total estimated cost being £351.

Calne R.D.C.—The tender of Mr. Palmer, Bremhill, at £23, has been accepted for the construction of a raised wood footway at Lowbridge to allow of pedestrian traffic in times when the road there is flooded.

Dover T.C.—Consideration is being given by the council to a proposal for the improvement of the road between Connaught Hill and Castle Hill.

Dublin T.C.—The corporation have recently acquired a motor wagon for watering the streets, and arrangements are being made for the purchase of another. The wagon cost £900.

Foleshill R.D.C.—Seven streets are in course of construction—two in Bedworth, two in Foleshill, and three in Stoke.

Lanarkshire C.C.—The Lower Ward Committee propose to expend on tar-macadam and tar-spraying work on the roads during the current year a sum of

£3,944, the improvement cost being £2,699. Towards this the Road Board propose to make a grant of £1,000. It was represented to the board by the Ward Committee that the grant is both less as regards total amount and in proportion to expenditure than in former years, and that there does not appear to be any sufficient reason for such a marked reduction, particularly in view of the fact that in the Lower Ward it is necessary to keep up a very high standard of road maintenance, because of the large amount of fast and heavy traffic passing over the roads.

Lancaster T.C.—Plans and specifications are being prepared by the borough surveyor, Mr. A. G. Bradshaw, for making up County-street and Fairfield-road.

Merthyr T.C.—An effort is being made to come to terms with Hill's Plymouth Company for taking over the tram road between the Theatre Royal and the lower end of the town, with the view of relieving the traffic in High-street; also with the object of improving the narrow thoroughfare from Bridge-street to the Mardy. The borough engineer, Mr. A. J. Marshall, has been requested to prepare a full report.

Middlesbrough T.C.—A scheme for the construction of streets on the area between Roman-road and the old skating rink has received the approval of the Plans Committee.

Newhaven R.D.C.—Plans and estimates are being prepared of the proposed new road from Newhaven to Seaford. When the military requisition was put on a report on the existing road accompanied it. This stated that the road was not in a good state of repair, that it was too narrow, and that there were bad corners at six points. It was therefore proposed to construct a new road, 20 ft. in width, from a point near Newhaven Town Station across fields to beyond Foxhole. Next it was proposed to repair and make the existing road 22 ft. wide from the point beyond Foxhole and halfway between Bishopstone and Seaford, and finally construct a new road as far as the corner of the road prior to arriving at the Buckle Archway.

Perthshire C.C.—The Blairgowrie District Committee have received a report from Mr. Alex. Forbes, road surveyor, Dunfermline, on the proposed opening of new quarries, and on the main roads in the district. This was referred to the Emergency Committee to consider, and meanwhile the clerk was instructed to write to the Local Government Board asking for a grant towards the increased cost which would be necessitated in connection with tar-grouting instead of water-binding the roads. The surveyor estimated that he would require £1,900 for road maintenance for the next quarter, £250 of special grant for surface-tarring in village areas (half payable by Road Board), and £1,500 of balance of estimate for road improvement on Perth, Coupar-Angus, and Bridge of Cally roads under the Road Board Development Grant—total, £3,650. To meet this and other expenditure it was agreed to requisition the County Finance Committee for £3,829.

Shipley U.D.C.—Improvements are to be carried out in Hargreaves-square, at an estimated cost of £550.

Shoreham U.D.C.—A letter has been received from the Road Board stating that now the heavy traffic had ceased they would put the whole of the roads into thorough repair, the council to contribute a sum each year towards payment, less interest. This offer has been accepted by the council.

Shoreditch B.C.—The council are pressing upon the London County Council the urgency of the proposed improvement at the junction of Old-street and Kingsland-road.

Wilton R.D.C.—A cheque for £4,000 has been received from the Road Board in connection with the work which is being done on the roads on behalf of the Government, and on the recommendation of the surveyor, Mr. R. A. Skelton, the council have resolved to make application to the Road Board for a further £6,000.

SEWERAGE AND SEWAGE DISPOSAL.

Arundel T.C.—The tender of Messrs. Duke & Ockenden, at £33, has been accepted for a new sludge pump for the sewage works.

Hebden Bridge U.D.C.—The council at their last meeting decided to purchase, after a successful trial on their sewers, a plough and cleanser from the Eccles Corporation drainage inspector, Mr. James Caine. Mr. Caine is the patentee of the appliance, which has met with much favour.

Midsomer U.D.C.—The surveyor, Mr. C. H. Sunderland, has prepared a scheme of sewage disposal enlarged to meet future requirements, and the subject is receiving the attention of a special sub-committee.

Rugby R.D.C.—The surveyor, Mr. T. W. Willard, reported recently that the plans of the Newbold sewage disposal scheme were nearly completed, and it was intimated that, when finished, they would be forwarded to the parish council.

Whiston R.D.C.—It is proposed to provide contact beds for the Whiston sewage on similar lines to those at Golborne.

WATER, GAS, AND ELECTRICITY.

Aysgarth R.D.C.—A report is to be prepared upon a proposed scheme for the improvement of the Bainbridge water supply.

Birmingham T.C.—The Baths Committee recommend the installation of a filtration system at the proposed baths in Institute-road.

Blackburn T.C.—An intimation has been received that the Treasury would raise no objection to the proposed loan of £2,100 for the construction of the Parsonage reservoir.

Bridlington T.C.—The acting borough electrical engineer, Mr. F. French, reports that on last year's working of the electricity undertaking there was a deficit of £313, compared with a profit last year of £1,372, the loss being directly due to the war. The deficit would be met by the balance of profit brought forward at March 31st, 1914, which stood at £3,056.

Derry T.C.—It has been decided to reduce considerably the street lighting, owing to the difficulty in obtaining coal.

Erith U.D.C.—Consideration is being given to a report by the electrical engineer proposing extensions to the electricity undertaking involving an outlay of £20,000. Meanwhile tenders are being invited for certain new plant.

Hastings T.C.—The Electricity Committee report a nett profit of £845 for the year ended March 31st last.

Holmfirth U.D.C.—The surveyor, Mr. G. Bray, has been directed to ascertain the terms for a water supply from the Huddersfield Town Council for Holmfirth and Netherthong.

Lincoln T.C.—The nett profit of the gas undertaking for the last financial year was £4,901, or £3,021 less than in the previous year.

Liverpool T.C.—In the annual report of the water undertaking some details are given of the progress of afforestation work undertaken by the corporation. In the Rivington area 190,400 trees, chiefly alder, sycamore, ash, birch, and poplar, were planted. In the Vyrnwy area the number of trees planted out during the year ended June, 1914, was 509,825. This was the first year's planting under the agreement between the corporation and H.M. Treasury, which provides for an average of 200 acres being afforestated every year for a period of twenty years.

Malton R.D.C.—The Local Government Board suggest certain amendments of the proposed Whitwell water supply, and intimate that if these are carried out there will be no objection to a loan for the work. The estimated cost is £820.

Melton Mowbray U.D.C.—With respect to the appointment of an engineer to go into the question of the town water supply, a member suggested at the last meeting that under the existing conditions it would be desirable to postpone the matter for six months, when there might be more prospect of a loan being sanctioned. It was eventually decided to go into the matter in committee a month hence.

Patrington R.D.C.—The council on Saturday decided to take a supply of water from the Hull Corporation for their district, which comprises about thirty parishes, including Crown lands at Sunk Island, where 10,000 acres are available for small holdings as soon as water is obtained.

Plymouth T.C.—The Electricity and Public Lighting Committee have decided to increase the price of electricity ½d. per unit from September next. They came to this decision very reluctantly, but felt they had no alternative in view of the fact that the price of coal had risen 90 per cent.

Portrush U.D.C.—The council have accepted the tender of Mr. John C. Hynds, at £598, for laying a water main in the extended area. A loan of £650

was sanctioned by the Local Government for the purpose, but the Commissioners of Public Works have not issued it, and the board have intimated that they will not object to the money being obtained by private loan. The council have fixed the period for the completion of the scheme at three months.

Sunderland T.C.—After meeting capital charges, the balance of £4,653 from the electricity undertaking is to be carried to depreciation and renewals account.

Tunbridge Wells T.C.—The electricity undertaking in the last financial year earned a gross profit of £9,628, or 9·8 per cent on the capital average. The engineer in charge has introduced a number of improvements in the machinery, resulting in a saving in working expenses which has more than counterbalanced the increases caused by the war. The outstanding liabilities of £100,000 with which the undertaking started have been reduced to £30,000, with every prospect of further reduction at no very distant date.

Wincanton R.D.C.—The Local Government Board have approved of the council's scheme for the Henstridge water supply, but state that, owing to the present condition of national affairs, they are unable to sanction a loan at the present time.

Wolverhampton T.C.—It has been decided to purchase two automatic stokers for the generating station, at a cost of £900.

Worcester T.C.—The accounts of the electricity department show that there was a profit of £961 on the actual working during the year ended March 31st last, but £879 was appropriated for improvements and additional works, and the nett profit was £81.

MISCELLANEOUS.

Axminster R.D.C.—The surveyor, Mr. G. A. Millard, stated that he had decided not to apply for a post under the urban district council of Axminster. His salary had been reduced £3 per annum, and he applied for that amount to be restored. It was decided to reduce his salary by £3 on account of the reduction in mileage caused by the formation of the urban district, but that his salary be increased by this amount in consequence of the work entailed by the discharge of his clerk.

Brighton T.C.—The borough accountant has been directed to arrange for application to be made for £60,000 in the War Loan.

Exeter T.C.—The Joint Estates and City Extension Adjustment Committees recommend alterations in the surveyor's staff engaged on the repair of council property involving the eventual reduction of the staff of ten men to two or three, the council retaining for the time being men who, owing to age and long service, would have difficulty in finding work elsewhere.

Fulham B.C.—A letter has been received from the London County Council stating that they have considered the question of steps being taken to ensure the acquisition during the summer months of stocks of household coal to be sold during the winter at prices agreed with the Government, and suggesting the desirability of local authorities who may own any public utility undertakings taking steps to secure their maximum stocks.

Worthing T.C.—The council have adopted the recommendation of the Finance Committee to invest £1,800 in the War Loan.

The Treasury and Hospital Expenditure.—On Tuesday, at a meeting of Dundee Public Health Committee, considerable discussion took place over a report submitted in connection with a visit by an inspector of the Local Government Board on the subject of proposed pavilions at Dundee King's Cross Hospital for tuberculosis patients. It was reported that the Local Government Board had at the instance of the Treasury suggested that the cost of the building, estimated at £15,000, should be cut down, and as the result of the visit of a representative from the Local Government Board the expenditure had been cut down about £600. Various members of the committee offered criticism on what they described as a paltry cutting down of such a large scheme. It was pointed out that the Treasury was supreme in matters of large expenditure such as was involved in this scheme at times like the present, and Treasurer Soutar expressed the belief that there was little likelihood of the scheme being sanctioned by the Treasury. It was agreed that the amended proposals should be submitted to the Local Government Board with a view to their getting the approval of the Treasury to the expenditure.

PERSONAL.

Mr. A. Everingham, acting borough surveyor of Bridlington, has joined the Army.

Mr. D. Bell, surveyor to the Windlesham Urban District Council, has had his salary increased by £45 per annum.

Mr. Donal Reid, burgh surveyor and sanitary inspector of Wick, has been appointed burgh surveyor of Inverkeithing.

Mr. A. E. Slater, deputy borough surveyor of Colchester, has been appointed borough surveyor of Newport, Isle of Wight.

Mr. G. H. Hargreaves, of the city engineer's office, Oxford, has been appointed as Second Lieutenant in the Royal Engineers.

Mr. Robert Marshall has been appointed surveyor of Limavady in succession to Mr. S. Macartney, now assistant county surveyor.

Mr. T. H. B. Heslop, county surveyor of Norfolk, was prevented by illness from attending the quarterly meeting of the Norfolk County Council on Saturday last.

Mr. J. W. Spark, electrical engineer and manager of Plymouth, has been appointed borough electrical engineer of West Hartlepool, at a commencing salary of £400.

Mr. W. O. Hughes, surveyor to the Bettws-y-Coed Urban District Council, has resigned with the intention of joining the army, and his resignation has been accepted.

Mr. J. V. Wall, surveyor to the Droitwich Rural District Council, was presented recently by the roadmen with an ebony walking-stick as a mark of appreciation and good feeling.

Mr. W. K. Gibson, county road surveyor of Wigtownshire, has been presented on his marriage with an escritoire and motor-car clock by roadmen and others in the Rhins district.

Irene, the youngest daughter of Mr. Edward W. Ingamells, district surveyor under the Bournemouth Town Council, was on Saturday married at Bournemouth to Mr. Ernest Harrison, of Banbury.

Mr. A. O. Harpur, surveyor to the Caerphilly Urban District Council, has resigned his appointment on account of failing health, and Mr. T. H. Richards, deputy surveyor, has been appointed his successor.

Mr. W. Walton, assistant in the surveyor's department, Rowley Regis, has joined the Worcestershire Yeomanry, and the urban district council have agreed to supplement the army pay to make up his full official salary.

Mr. E. C. Carter, sanitary surveyor to the Chard Rural District Council, having joined the army sanitary department, the council have agreed to pay him a sum up to £75, if it be necessary, to make his income up to what it had been.

Mr. George Beaton, burgh surveyor of Lockerbie, who was unanimously offered by Moffat Town Council the appointment of burgh surveyor and sanitary inspector in succession to Mr. Wm. Cuthbertson, has intimated the withdrawal of his application. The town council are in consequence taking steps to select a short leet from among the remainder of the thirty-three applicants for the post.

Pudloed Cement Roofs.—The Bolton new schools have flat roofs over the verandahs, and we learn that the architect to the Education Committee is constructing these flat roofs with waterproofed cement concrete. We understand further that Pudloed cement roofs are being increasingly specified.

Manchester City Surveyor and his Staff.—The report of the Town Hall Committee of the Manchester Corporation recommending that three men dismissed by the city surveyor, Mr. T. de Courcy Meade, should, "with the approval of the city surveyor, be reinstated," was discussed at considerable length at the city council meeting on Wednesday. An amendment was carried to leave out the words "with the approval of the city surveyor," but after further discussion the whole question was referred back for further consideration. The city surveyor stated that the men were dismissed on grounds of economy, and because there was no work for them to do, and the opponents of the report contended that they were dismissed because they refused to enlist.

Heavy Traffic.*

By HARCOURT E. CLARE, Clerk of the Lancashire County Council.

In considering the subject of heavy traffic regard must be had on the one hand to the benefit and assistance to trade and to the convenience that will accrue to a portion of the travelling public by encouraging it, and on the other hand to the increasing burdens that must fall on the taxpayer and ratepayer if the roads are maintained in a satisfactory condition to carry the traffic, and also to the convenience and safety of all other kinds of traffic having a right to use the roads.

The conditions pertaining to the transit of both passengers and goods in this country have been for the last few years and still are changing and developing along new lines, and although this has mainly been brought about by the extension of mechanical science in the construction of the vehicles, the change has also been accelerated by the inconveniences to trade caused by disputes between employers and employed in connection with our railways and sea ports. The development of motor traction has made it possible for traders to a certain extent to counteract the evil effects to trade arising from the congestion of traffic on the railways and at the docks, and has no doubt, generally speaking, reduced the cost of transit on the goods conveyed and facilitated quick delivery.

In such circumstances there has been a tendency for those who could see their way to make money or save expenditure by using the newer class of heavy vehicles to exercise their public right of user of the roads in a manner and to an extent not previously anticipated, and with little regard to the increased expenditure thrown on the public purse, or to the inconvenience caused to other traffic by breaking up roads which would otherwise be satisfactory. But the continuance of such excessive exercise of a public right may be the means of bringing about its own undoing by compelling those who have the care of the public purse to take up a hostile position to the heavy traffic development, and, with the support of the great majority of the public, to obtain Parliamentary curtailment of the existing privileges to an extent that may seriously hamper the extension of heavy traffic on the public roads.

This, however, is much to be avoided, and the whole subject requires to be approached without delay, and with a desire to act with consideration for the different interests concerned, and all parties interested should co-operate in an earnest endeavour to agree on a set of conditions which, while placing reasonable limitations on the user of heavy vehicles on the roads, will yet not go to the extent of seriously checking the development of methods for cheapening and facilitating the transit of goods and passengers.

The main difficulty of road authorities at the present time has arisen through the extension of mechanical traction in road transit having outpaced their capacity to adapt roads which were, generally speaking, constructed and maintained for the lighter horse traffic to the new requirements. The new kind of traffic has also brought with it a great expansion in the distances travelled. Roads which, so far as the user is concerned, were previously almost purely parochial have become county, and those which were previously county have become national. While these changes have quickly come about, the financial burdens of the maintenance of the roads, based on the old conditions of user, have still remained substantially unaltered, and many thousands of miles of road in the country are not constructed in a manner that makes them capable of bearing the wear caused by this heavy traffic. To put it shortly, the road authorities are faced with two difficulties—namely, the practical impossibility of so reconstructing the roads within a short period as to adapt them to the new character of traffic, and, secondly, the injustice to ratepayers if the money for the purpose has to be found under the existing financial conditions.

But the financial question is, after all, the crux of the whole position, and until that is satisfactorily settled the progress of the reconstruction and improvement of the roads will necessarily be slow. The grants made by the Road Board from Imperial funds are an assistance, so far as they go, to the road authorities in carrying out improvements to the roads, but the acceptance of a grant almost invariably involves an increased expenditure out of the rates. In 1913 an important step was taken towards making a classification of the roads in the country based on their relative importance for carrying traffic of a national, county, or more purely local character, and when this has been completed it will be a guide for making a more equitable adjustment of the burden of the cost of the roads between the National Exchequer and the various bodies of local ratepayers. In the same year a Government Bill was drafted to provide for increased contributions from the Exchequer towards the cost of roads, but it was not proceeded with, and the financial position remains the same as before.

When the county and county borough councils were created by the Act of 1888, Parliament intended that half the cost of main roads should be provided by the National Exchequer, but the financial arrangements made to carry out this intention have in the course of time proved to be wholly inadequate for the purpose.

By way of illustration it may be mentioned that the expenditure of the Lancashire County Council on main roads was, in 1906, £144,000, and the contribution from the Exchequer Contribution Account was £61,000. In 1915 the expenditure was estimated at £224,000, and no contribution from the Exchequer Contribution Account is available. When it is also borne in mind that this increasing burden on the ratepayers for the maintenance of roads is largely caused by traffic passing from one county borough to another, which bear no share of the county rates, it can hardly be expected that, so long as these conditions continue, any rapid progress will be made in the reconstruction of county roads, and it would be a gross injustice to the ratepayers if it were done. But even if the financial difficulties were removed it will still take several years in most counties to complete the necessary improvements, which cannot be well done with unskilled labour, and any attempt to "rush" the work would put up the price of materials. In view of these circumstances any new proposals that may be made for providing for heavy traffic and regulating it should be framed with regard to the existing conditions, and not on the assumption that it is the duty of the road authorities to have every road constructed to carry heavy mechanical vehicles (whether for goods or passengers), as soon as a few individuals, for their own profit, desire to run the vehicles on that road.

It is impossible exactly to define the line when the exercise by an individual of his legal right of user of a highway becomes, by nature of the user, such an abuse or public nuisance as to require the intervention of Parliament. As a general principle, if a road is constructed to bear heavy traffic, then, subject to reasonable limitations with regard to weight, size, character of tyres, and pace of the vehicle, the traffic should be encouraged in the general interests of trade; but if an individual chooses, for his own profit, to send heavy vehicles along roads which have neither foundations nor surfaces fitted to carry the weight of the loads, instead of sending them by another route where the roads can bear the effect of the traffic (and the extra distance would not be unreasonable), then it becomes desirable in the public interest that power should be given to the road authority, if they think fit, to cause him to refrain from using the shorter route, unless the traffic comes under the definition of "extraordinary traffic," and he becomes liable to pay for the special damage done. It is unfair to the ratepayers that two or three of their number should be able to save a few hundred pounds a year in railway rates at a cost of some thousands of pounds a year to the public purse.

It is to the interest of every authority that has to levy rates to try to increase the assessable value of its area, and, subject to special exceptions, it may safely be left to the road authority to decide if it is in the interest of those they represent to exclude certain unfit roads from traction engines and heavy motor traffic, and especially motor-'bus traffic, altogether, or to allow the traffic provided the vehicles comply with certain limitations as to weight, &c., and with or without a special contribution towards the repair of the roads. Heavy castings or other indivisible articles must be allowed to go by road,

* Paper read at the recent National Road Conference in London.

rule, such a user of the roads comes under the description of "extraordinary traffic," and the special damage done is liable to be paid for by the person responsible for causing it.

bulk, it is very desirable, in the public interest, that the load on any vehicle shall be more limited than it is at present, and that certain kinds of tyres on wheels which by experience have been proved to cause special damage to roads shall be prohibited.

From reports made by road surveyors it would appear that motor 'buses running frequently on a definite route, and picking up passengers by the way,

bound macadam road than other vehicles, which, though carrying heavier weights, run less regularly and at a less speed; and this also applies, in a lesser degree, to the tar-macadam roads.

In the case of a road tramway for passengers the owners of the undertaking have to reconstruct that portion of the road which is occupied by the track at their own expense; they have afterwards to maintain it; they have to pay rates on the assessable value of the track; and usually they are placed under obligations with regard to regularity of service, and in giving cheap fares morning and evening for the working classes. None of these burdens or obligations attach to a company which chooses to start a service of motor 'buses between certain points along a road, and it is unfair to the general body of ratepayers that they should have to bear the burden of the extra expenditure incurred in keeping the road in repair in consequence of this particular service. It is only reasonable that a special contribution towards the increased expenditure should be required from the company running the motor 'buses, and this will only be putting the motor-'bus service somewhat on a level with the tramway service.

Where motor 'buses or chars-à-banc are used more or less casually, the road authorities should have power to schedule any roads which, by reason of their want of width, bad corners, or dangerous inclines and construction, make it undesirable, in the general interests of safety to other traffic, that these vehicles of large size should be allowed on those roads.

It is desirable that the question of regulating motor 'buses and chars-à-banc, and the special charges to be imposed on their user, be dealt with separately from that relating to other heavy traffic.

The Acts of Parliament and Orders relating to traction engines, heavy motor cars, and light motor cars want revising and consolidating.

Leaving motor 'buses for the moment out of the question, there ought not to be much difficulty in representatives of road authorities, and manufacturers and users of heavy vehicles of all kinds, agreeing upon a classification of the vehicles, and the conditions to be made applicable to each case.

Class I. might include vehicles with limited weights which should be allowed without question (except in some special circumstances) to use any

Class II. might include vehicles not exceeding some greater weight, but in regard to these the road authorities should have power to exclude their user (except with consent) of certain roads which for the time may be scheduled as unfit to bear the traffic.

Class III. might include vehicles of still heavier weight than Class II. (including traction engines), which should require the licence of the road authorities before being used.

If some scale of this kind could be settled, then both manufacturers of vehicles and the users would know exactly the conditions pertaining to each class, and could regulate their business accordingly.

With regard to every kind of traffic, it would be to the general public interest to give road authorities power to regulate traffic along a section of a road while it is under reconstruction or repair. As indicating generally what is proposed, if a road authority will take care when doing repairs on a road to leave a track sufficient to allow one vehicle at a time to pass without going on the part under repair, they should then have power to regulate the traffic in the interest of the public purse, as the police have power in boroughs to regulate it for the safety and convenience of the public, so as to provide that only one vehicle shall pass at a time along the track coterminous with the section of the road under repair. In fact, in cases where the traffic could, without inconvenience, be temporarily diverted along another road, it would be a great advantage for the road authorities to have the power of closing a road altogether during reconstruction; but this, of course, would not apply so as to affect ordinary access to property.

For the purpose of the Imperial Exchequer, licence duties upon some sliding scale should be imposed on all heavy vehicles, with an additional provision for the payment to the road authority for special damage done to the road by motor 'buses and extraordinary traffic.

There are other points of detail relating to drivers and their conduct which should at the same time be dealt with.

The writer has for many years past held the view that the best remedy for some of the difficulties with regard to railway rates and delivery which have arisen between the railway companies and traders is by the development of road transit, and that it would be to the best interests of the country for a large capital expenditure to be incurred in the widening of roads, the improvement of steep gradients, and the reconstruction of the foundations and surfaces where required, in order to provide facilities by road for the quick delivery of goods without transhipment from the point of production to the distributor or consumer. Within a period of, say, twenty years after the expenditure, a permanent value of probably 50 per cent would remain in the roads with the debts discharged. But before such a scheme could be entered upon there must be made the financial readjustment of the burden between the Imperial and local purse, and also between special users of the roads and the public.

INSTITUTION OF MUNICIPAL ENGINEERS.

COUNCIL MEETING.

At a meeting of the council of the Institution of Municipal Engineers held in London on June 30th the following applicants were recommended for ad-

To Membership: Mr. A. Routledge, surveyor, Stanley Urban District Council.

To Associate-membership: Mr. G. F. Whitelock, assistant surveyor, Godstone Rural District Council.

New Members, &c.—From the applicants recommended for admission at the last meeting two members and one associate-member were elected, and two associate-members were transferred to membership.

District Committee Expenses.—A committee, consisting of the hon. treasurer of the institution (Mr. T. Mundy), the chairman of the Finance Committee (Mr. F. Cutler), and the hon secretary of the Northern District (Mr. W. Wallin), was appointed to discuss and report upon the question of expenses of district Committees.

Nominations.—The following members were nominated by the council for the offices named:—

President: Mr. Henry C. Adams, M.INST.C.E., M.I.MECH.E., F.R.SAN.I., consulting municipal engineer, 60 Queen Victoria-street, London.

Vice-presidents: Messrs. A. R. Bleazard, Arthur Bowes, ASSOC.M.INST.C.E., H. J. Farmer, William Finch, and Edward Whitwell (re-nominated), and Messrs. Thomas Mundy, deputy borough engineer, Woolwich, H. C. H. Shenton, civil engineer, 28 Victoria-street, Westminster, and William Wallin, consulting municipal engineer, Newcastle-upon-Tyne.

Hon. Treasurer: Mr. Thomas Mundy (re-nominated).

Subscriptions.—The financial year, 1914-1915, ended on June 30th, and members who have not paid that year's subscription are requested to remit without delay. The subscription for 1915-1916 falls due to-day.

The next council meeting will be held at Newcastle,

Coast Sand Dunes, Sand Spits, and Sand Wastes. (By G. O. Case. Price 5s. St. Bride's Press, Limited, 24 Bride-lane, E.C.). . . . "A most useful little book crammed with facts culled from all parts of the world and well illustrated with photographic reproductions and diagrams. Numerous references to other works are given. Mr. Case discusses the formation and distribution of sand dunes and the devastation caused by them when they move inland, and then goes on to consider protective works and the reclamation of sand wastes. If we have one criticism to offer it is that the book is too condensed. There is certainly not a superfluous paragraph."—*Geographical Journal.*

Some Recent Experiences in the Maintenance and Resurfacing of Roads, Particularly on Clay Subsoil in the Vicinity of the Metropolis.*

By JAMES A. WEBB, Engineer and Surveyor to the Hendon Rural District Council.

So many papers relating to the road subject have from time to time been submitted for the consideration of the members of the institution that it has become exceedingly difficult for the author of a paper to break new ground, or to give in a presentable form further views worthy of serious discussion. But, as experience is never dear to those who profit by it, the author ventures to present certain details of the results of recent work carried out by him in the district in which his activities are more particularly engaged.

As has already been premised by the title of the paper, the author has pleasure in setting forth the result of his experience in the work of resurfacing roads in a district possessing a clay subsoil. The whole of the roads were originally constructed without under-drainage or foundation of any description, and, in many instances the level of adjoining land lies above that of the carriageway. As a consequence the road becomes waterlogged, with the result that the clay (owing to the action of the traffic, aided by climatic conditions) worked through the always inadequate layer of gravel which, for the most part, formed the crust of the road surfaces, and simple resurfacing, whether by water-bound granite or by one of the many methods of resurfacing roads now adopted in various districts, is, in the absence of adequate and proper foundations, simply a waste of material, labour and money.

Some years ago the author presented several reports to the authority of his district on the effects which the increasingly heavy motor traffic had upon the roads in the immediate neighbourhood of the Metropolis (and which forms part of Greater London), and in consequence was authorised to adopt the method of substituting granite for the resurfacing of roads which had previously been maintained with gravel, and also, wherever it was found necessary, to excavate the soft or weak places in the roads, to remove the clay subsoil, and substitute hardcore to act as a foundation. During the progress of the work many complaints were received from motorists, cyclists and others, it being found impracticable to carry out the work in sections or half-widths.

Upon one of the roads in the district which is now subjected to exceedingly heavy traffic, including a regular service of motor omnibuses, where the centre of the road in places became lower than the sides, the author found it necessary to excavate the carriageway on each side to a width of about 6 ft. and to a depth of 18 in., and to lay drains to the ditch. In order to drain the subsoil the excavations were filled in with hardcore, and consolidated with a steam roller, the surfaces being afterwards covered with granite coated with bituminised material. This has proved most successful, preventing, as it does, the centre of the road from spreading, and also the clay from working through and causing corrugations and irregularities in the surface of the road.

An important factor in the development of road traffic is the increasing burden of upkeep, owing to the vastly increasing numbers of the heavier forms of self-propelled vehicles, such as lorries and motor omnibuses. The effect these vehicles have on the road surfaces when particularly considered is of an exceedingly onerous character, and the monetary burden so created is too great for any ordinary district to bear.

[illegible] the author to secure a somewhat reasonable and suitable road surface. In almost every instance, however, the result has not been satisfactory, owing to the imperfect drainage of the subsoil.

In that year a short section of road, carrying fairly heavy local traffic, was laid by the author with slag mixed with tar, and has only been resurfaced once since. This particular section of road is kerbed and channelled throughout, and has shown no tendency to creep, while another section laid on precisely similar lines, with a grass verge on each side, began to move within a very short time after the tarred slag was laid. The cost of the work was 3s. 4d. per yard super.

A length of road having a considerable amount of through traffic was treated by scarifying the existing surface, levelling, rolling and forming to proper contour. It was then covered with 3 in. of Leicestershire granite, and grouted with hot tar by means of cans, with specially made fan-shaped outlets to secure equal distribution. Granite chippings, mixed with lime in a dry state, were then spread over the surface and swept in with a broom and well rolled with a 10-ton steam roller. Granite chippings were again lightly spread over the surface, the roadway being then thrown open to traffic, with the result that in a short time the tar worked to the surface in patches and adhered to the wheels of passing vehicles. The result was that a further supply of granite chippings was necessary to gain the desired object of keeping down the tar.

Another section was treated in a similar manner [illegible] being broken up. It was carefully swept and surface-tarred before the granite was spread. After the latter had been dry rolled it was tarred as before, and a mixture of sand and cement was well brushed into the voids and again rolled and covered with granite chippings. This proved more lasting, and retained a fairly good surface for about two years, when it broke up.

About the same period a number of other experiments were carried out by the author with a view to securing a fairly uniform road surface of an economical character. Various methods were adopted by him similar to those adopted by Mr. Gladwell, which proved to be most suitable in his and many other districts. Unfortunately, the methods were not a success in the author's case, owing to the elasticity of the clay subsoil, although each section of road was treated in a somewhat similar manner. There was, however, a vast improvement to be seen over water-bound surfaces, both in maintenance and scavenging, and in a saving in watering, owing to the amount of dust being greatly reduced. The cost of the various trial sections varied from 1s. 11d. to 2s. 3d. per yard super.

[illegible] the author has tried many tarring and bituminous methods of construction with varying results, the most satisfactory being obtained by the use of bituminised granite. In 1908 a short section of road was resurfaced with Leicestershire granite in the usual manner, and grouted with bituminous material. Granite chippings were spread over the surface and consolidated with a steam roller. The result was very satisfactory. It is only fair to [illegible] a severe thunder-storm, which did not affect the material in any way, and the surface of the road was not broken up until last year, when it was resurfaced with material of the same description. The author has since continued the use of granite, either grouted or mixed with bituminised material, in resurfacing the principal roads in his district.

[Mr. Webb here gave a table showing that the road is subjected to an exceedingly heavy traffic for an ordinary district road, and tending also to show the vast increase in the number of vehicles, and the total weight which roads now have to sustain in some semi-rural districts.]

During the past year the author has used both Leicestershire and Clee Hill granite, and has had the material mixed by hand labour with several kinds of binding substances, including both crude and heavy tars. This, he finds, costs considerably more than having the material mixed at the quarries and delivered in trucks to the nearest depot. The result in each case has been satisfactory, and although the cost of resurfacing with Clee Hill granite per yard [illegible] shire granite, the author is of opinion that the surface of the different sections of road fully justify the

* [illegible]

use of the more expensive and better-class material. The binding materials used were precisely similar in each case.

The method adopted was to form the old surface of the road to a regular contour, and scarify a cutting about 3 in. deep, about 1 ft. from the edge of the footpath or greensward, to form a key to prevent the finished material spreading. The new material was then spread evenly over the surface, about 3 in. in thickness, and consolidated with a roller. The surface was then covered as thinly as possible with ¼-in. granite chippings treated with the same material, and again well consolidated by rolling. The author wishes here to point out that the method described does not provide a voidless surface. It is, however, fairly smooth and regular, and no complaints have ever been made as to slipperiness, even in frosty weather. The material was in one or two places laid on gradients of 1 in 21, and appears to afford a good foothold for horses.

The author has taken out the cost of a considerable area recently completed under very adverse climatic conditions.

The following are the details of the cost of resurfacing and also the cost of strengthening the soft places in the road:—

Cost of Re-surfacing Road with 1¾-in. Bituminised Granite.

	£	s.	d.
Area:—2,638 super. yards.			
Labour	11	10	10½
Steam roller, 15¼ days at 25s.	19	7	6
Team labour, 5½ days at 8s. ...	2	4	0
Watchman, 12 days at 3s.	1	16	0
Material—			
216 tons 11 cwts. 1½" bituminised granite 39 tons 14 cwts ½" bituminised granite, including cartage } at 18s. 6d.	237	0	7½
Coke, 17 cwts. at 1s. 6d.	1	5	6
	£273	4	6
Establishment charges	27	6	2
	£300	10	8

Area covered, 2,638 yards super.
Cost, 2s. 3¼d. per yard super.

In addition a sum of £20 12s. 11d. was expended in strengthening the foundations in several places where the crust of the road had been broken up by a trench for a gas main, which caused the clay to work from the foundation to the surface.

It is an interesting fact that during the last four years the motor-omnibus traffic alone—which now extends from London for considerable distances into the country—has increased by 130 per cent, with every prospect of a still further increase and extension.

It is common ground that heavy motor and mechanically propelled traffic seriously affects all unprotected road surfaces by its disintegrating effect. The only remedy for this state of things is the employment of a cohesive binder for the structure of the road surface, which has the effect of preserving the surface of the road, and which conduces to its power of resistance in connection with the vibratory and disintegrating effects of modern traffic.

By careful observation of the various experiments which have been made throughout the country by those interested in the maintenance of highways, the author has arrived at the conclusion that, particularly in districts where the subsoil is composed of clay, the lack of satisfactory results is, for the most part, to be attributed to the wheel action of heavy mechanically propelled vehicles, especially where roads are not provided with adequate foundations.

By the use of a plastic aggregate the most successful results have been obtained, owing to the comparative elasticity of the material, and any cross-sectional movement is speedily remedied and corrected by the varying forms of traffic using the roads.

These facts prove that heavy motor traffic on any ordinary district road renders water-bound macadam an expensive and altogether unsuitable material, owing to the usually imperfect foundations and the method of consolidation and maintenance of an equal or reasonably level surface. Where the subsoil is clay it cannot, without treatment, be expected to resist the heavy traffic, and consequently the surface of the road becomes uneven within a very short time after being thrown open to traffic.

In conclusion, the author would point out that, when the surfaces of the roads are tar-painted and covered with granite chippings in the ordinary manner, the surfaces become practically waterproof. The nuisance caused by dust raised by rapidly moving vehicles is reduced, and there is a considerable saving in road watering.

The question of cost of future maintenance and repair of highways is one of great importance to the smaller urban or rural districts.

Under present arangements the various classes of traffic require all main roads and local or district roads to be constructed and maintained with surfaces perfectly smooth and free from loose stones, &c. The dust problem is one which pedestrians and occupiers of property in particular areas adjacent to the highways feel most acutely, and it is evident that some consideration should be shown to them. In the majority of districts they are called upon to pay for the upkeep of the roads, and are not the actual users; therefore they do not cause the wear and tear which renders the increased cost of maintenance necessary, and it is manifestly unfair that the public companies plying for hire, and traders using heavy locomotive vehicles which convey passengers and goods traffic, should be permitted to use and cut up the surface of the roads without contributing to the damage caused by the excessive weights and fast speeds at which the vehicles travel.

The classification of roads now under consideration by the county councils, in conjunction with the Road Board, seems a step in the right direction. By this means a better standard of road maintenance will be set up for each class, the cost of which will be partly defrayed by the county. In the author's own particular district a large number of the roads are used principally by through traffic, which increases year by year.

In the author's opinion the various trials and experiments in road surfacing prove conclusively that water-bound roads are not suitable for the present-day traffic, and whichever method has proved successful in the various districts is the proper course to adopt; but no surfacing material, whether of tarry, bituminous or asphaltic description, will be successful unless the primary objects are secured—viz., efficient drainage of subsoil, and adequate and sufficient foundations.

The general conclusions herein set forth are the result of both observation and experiment, and the author trusts that they may form the basis of an interesting and instructive discussion, and add something to the information of the members, who are naturally interested in this most important economic question.

London District Surveyors.—The Building Acts Committee of the London County Council report that they have consented to the appointment of deputy district surveyors in two cases. In another case a district surveyor who is on military service has been allowed temporarily to resume charge of his district during the absence of his deputy for a short period.

The Orphan Fund.—Mr. O. Claude Robson, M.Inst.C.E., hon. secretary and hon. treasurer of the Orphan Fund of the Institution of Municipal and County Engineers, desires to acknowledge the receipt of £1 received from the "Wandrers" through a vice-president of the institution. Mr. Robson understands that the amount was collected at a private gathering, which, he thinks, indicates that some interest is taken in the fund outside the public meetings of the institution.

Devon Road Schemes.—The Road Board have sanctioned a grant of £3,467 towards the Devon County Council's proposed new road schemes, the total estimated cost of which is £7,989. The board state that they are also prepared to consider favourably an application by the county council for a grant of £500 towards a scheme of surface-tarring at an estimated expenditure of £1,368, being £1,000 in addition to the sum which the board understand has been set aside by the council to be expended on this class of work during the current financial year. The board are of opinion that it would be desirable to include in the proposal the sections of road which had recently been reconstructed. Reference was made to a length of road between Penryn and Falmouth, which had cost the county £500 a mile. Motor-'bus traffic was largely responsible for the expenditure upon it. It would pay to put on the road better material than water-bound macadam. It was decided to repair a stretch having an area of 4,680 sq. yds., at a cost of £468, or 2s. a square yard.

TESTING OF ROADS AND ROAD MATERIALS.

THE UTILITY OF THE MICROSCOPE.

In the annual report of the National Physical Laboratory for 1914-15 it is stated that mechanical tests on 128 kinds of stone for road construction have been made during that period. Of these stones 123 were tested for resistance to attrition, 109 for resistance to repeated impact, 21 for resistance to abrasion, 12 for cementation value, and 1 for crushing strength.

If the sanction of the Road Board is obtained, it is proposed to put down a complete mixing plant for the production of asphalt carpets to be tested by the road machine. This will involve the erection of a sand drier, boilers for the heating of the bitumen, flux, and fluxed bitumen, and a batch mixer, together with all the necessary driving and weighing appliances.

Some modifications will also be made in the existing mechanism for causing axial motion of the test wheels in order, if possible, to diminish the production of "ruts" in the track.

The study of the roads tested in the road machine has been carried out largely by preparing and examining micro-sections of the road at various stages, and the report mentions that one road in particular furnished results which are of interest as indicating the utility of the microscope in the study of road-construction problems. Three different sections of this road were examined—viz.: (1) A part of the road as laid down—*i.e.*, previous to the commencement of the test; (2) a part of the road after completion of the test, taken from a place where the road was still in good condition; and (3) another part of the road after the completion of the test where the road was in a bad condition.

From each specimen a small piece was cut at right angles to the surface of the track, and this was carefully polished and examined and photographed under the microscope. In this way the structure both close to the surface and in the interior could be studied. The road in question contained 55 per cent of $\frac{3}{8}$-in. granite, the rest of the mineral matter being of smaller grading. It was found that in this case there was on the surface a "carpet" composed of bituminous matter and fine mineral matter, having a thickness of approximately $\frac{3}{8}$ in., all the large $\frac{3}{8}$-in. granite lying below this carpet. "The whole work of the road," the report states, "appears to be taken by the carpet, and if for any reason this is either penetrated or removed the road begins to disintegrate rapidly. In that section of the track which was in good condition at the end of the test the structure was found to be identical with that of the road as first laid down, but in the section of the part which was in bad condition the $\frac{3}{8}$-in. granite chips were visible in the surface."

Another road tested in the road machine broke up a few hours after the wet test, in which the entire surface is covered with water, had begun. A section of this road gave on analysis a very low percentage of bitumen, and when a similar road was laid again, using, however, a much higher percentage of bitumen, it withstood the water test for fourteen days. "This appears to show that with a certain grading there is a limiting percentage of bitumen which will make the road resistant to water action, although a much lower percentage will enable it to resist the same traffic in a dry state."

With a view to obtaining some information concerning the composition, grading, and micro-structure of various types of bituminous road, actual sections of roads in different parts of the country have been taken up, and are at present being examined. These include roads which have given very good results in practice, and also those which have failed soon after being laid down.

A New Lock for Molesey.—The Metropolitan Water Board having agreed to contribute one-half of the cost (estimated at £2,000) of the additional small lock at Molesey, the Thames Conservancy decided on Monday that the work should be proceeded with.

ROYAL SANITARY INSTITUTE.

YEOVIL MEETING.

At Yeovil, on Wednesday, a discussion on "Water Supplies to Rural and Small Urban Areas" will be opened by Dr. W. G. Savage, county medical officer of health of Somerset.

The proceedings will open at the town hall at 11.15 a.m., and will be presided over by Sir Henry Tanner, chairman of the council of the institute.

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

ANNUAL SUMMER CONFERENCE.

The annual summer conference of the Association of Managers of Sewage Disposal Works will be held at Leeds to-morrow (Saturday).

PROGRAMME.

10.45 a.m.—Assemble in the council chamber.
The Lord Mayor (Mr. E. Bedford) will welcome the association.
Dr. H. Maclean Wilson, M.D., B.SC., will deliver his presidential address.
Mr. Geo. A. Hart, M.INST.C.E., sewerage engineer to the city of Leeds, will explain the works of the main drainage and sewage disposal scheme.
Mr. John T. Thompson, chemist and acting manager of the works, will read a paper, "Seven Years' Experience with a Large Sludge-pressing Plant."
Discussion.

1 p.m.—Luncheon at Victoria Hotel (2s. per head).

2 p.m.—Char-à-banc will leave for the outfall works (about 2s. per head).

2.30 p.m.—The visitors will be conducted over the works by Mr. Geo. A. Hart, M.INST.C.E., and staff.

4.30 p.m.—Char-à-banc will leave works for Leeds Town Hall.

5 p.m.—Afternoon tea will be served in the Lord Mayor's rooms of the town hall, at the invitation of the Lord Mayor.

J. B. CROLL,
Secretary

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SURVEYOR AND SANITARY INSPECTOR.—July 10th.—Brumby and Frodingham Urban District Council.—Mr. G. S. Sowter, solicitor and clerk, Brigg, Lincs.

SEWAGE FARM FOREMAN.—July 10th.—Joint Committee of the Houghton-le-Spring Rural District Council and Hetton Urban District Council. £2 per week.—Mr. R. B. Marley, clerk to the committee, Union Offices, Houghton-le-Spring.

ASSISTANT ELECTRICAL ENGINEER. — July 12th.—Leek Urban District Council. £120 per annum. —Mr. H. Henshaw, clerk.

TEMPORARY BUILDING INSPECTOR. — July 12th.—Corporation of Plymouth. £100 per annum.—Mr. J. Paton, borough engineer and surveyor.

GAS ENGINEER AND MANAGER.—July 17th.—Abertillery Urban District Council. £250 per annum. —Mr. W. Gait, clerk.

DEPUTY MANAGER.—July 12th.—The Maldens and Coombe Urban District Council. 30s.—35s. per week.—The Clerk, Council Offices, New Malden, Surrey.

TEMPORARY ASSISTANT SURVEYOR. — July 21st.—Devon County Council. £3 per week.—Mr. W. P. Robinson, county surveyor (No. 2 Division), 22 Queen-street, Exeter.

ROAD FOREMAN.—July 24th.—Penge Urban District Council. £2 per week, with free living quarters. —Mr. H. W. Longdin, surveyor, Town Hall.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

WAKEFIELD.—July 12th.—For the erection of brick boundary wall, for the corporation.—City Surveyor.

CORNWALL.—July 12th.—For summer repairs to schools, for the Education Committee.—Mr. A. A. Clinnick, district clerk, District Education Office, Truro.

GLASGOW.—July 12th.—For alterations at Govan-street industrial school, for the School Board.—School Board Offices, 129 Bath-street, Glasgow.

HAMPSHIRE.—July 12th.—For sanitary alterations at Gosport police station, for the county council.—Mr. W. J. Taylor, county surveyor, The Castle, Winchester.

SLEAFORD.—July 12th.—For repairs to two bridges, for the rural district council.—Mr. F. H. Ellis, surveyor, 56 Grantham-road, Sleaford.

KENT.—July 12th.—For summer repairs at certain schools, for the Education Committee.—Mr. W. H. Robinson, architect, Sessions House, Maidstone.

EAST HAM.—July 13th.—For repairs to nineteen schools, for the Education Committee.—Mr. F. R. Thompson, secretary, Education Offices, East Ham.

SUNDERLAND.—July 15th.—For the erection of hospital blocks and alterations to laundry and gate-house, for the corporation.—Borough Surveyor.

EDINBURGH.—July 19th.—For the erection of a generating station, for the corporation.—Sir Alexander Kennedy, 17 Victoria-street, Westminster, S.W.

KENT.—July 19th.—For the execution of repairs at Burham and other schools, for the Education Committee.—Mr. W. H. Robinson, architect, Sessions House, Maidstone.

KENT.—July 20th.—For painting and repairs to county buildings, for the Kent Standing Joint Committee.—County Architect, 86 Week-street, Maidstone.

GLASGOW.—July 24th.—For relining chimney stalk with firebrick, for the corporation.—Mr. W. Greig, superintendent of cleansing, 20 Trongate.

SOMERSET.—July 28th.—For the rebuilding of Ham Bridge, consisting of the taking down of the existing bridge and erecting a new bridge with reinforced concrete, for the county council.—Mr. Edward Stead, county surveyor, County Council Offices, Wells.

Engineering: Iron and Steel.

SALFORD.—July 12th.—For the supply and construction of cast-iron pipes under river bridges, for the corporation.—Borough Electrical Engineer, Frederick-road, Pendleton.

BEDLINGTON.—July 12th.—For the supply of new or second-hand steam pumping engine, for the urban district council.—Mr. J. E. Johnston, waterworks manager, Bedlington, Northumberland.

MERTON.—July 14th.—For pumping a pond, for the urban district council.—The Sanitary Inspector.

MADRAS.—July 14th.—For the supply of cast-iron pipes, special castings, sluice valves and hydrants, for the corporation.—Mr. J. W. Madeley, special engineer; agents, Messrs. James Mansergh & Sons, 5 Victoria-street, Westminster, London, S.W.

ELLESMERE PORT.—July 14th.—For the supply of 900 yds. of gas mains and excavation work, for the urban district council.—Mr. T. W. Francis, clerk, Council Offices.

TOTNES.—July 15th.—For laying 3-in. cast-iron water main, for the rural district council.—Mr. W. J. Goode, surveyor, Buckfastleigh.

DRIFFIELD.—July 20th.—For the sinking of two boreholes, for the rural district council.—Mr. H. Botterill, clerk, 23 Exchange-street, Driffield.

MERTHYR.—July 26th.—For the supply of steel and cast-iron pipes, and for laying 3½ miles of pipe lines, for the corporation.—Sir Alex. Binnie, Son & Deacon, St. Stephen's House, Victoria Embankment, S.W.

GUILDFORD.—July 27th.—For the removal of old bridge and the construction of a new bridge, for the rural district council.—Mr. J. Anstee, engineer, Council Offices, Commercial-road.

RANGOON.—August 11th.—For the installation of a system of fire alarms, for the municipality.—Messrs. Ogilvy, Gillanders & Co., 67 Cornhill, London, E.C.

Gas and Electricity.

EDINBURGH.—July 12th.—For one 1,000-kw. motor converter and transformer, for the corporation.—The Engineer, Dewar-place, Edinburgh.

DUBLIN.—July 12th.—For the supply of carbons, for the Electricity Supply Committee.—City Electrical Supply Engineer, Fleet-street, Dublin.

BARKING.—July 16th.—For the supply of a 1,000-kw. turbo-alternator, cooling tower, chain grate stoker, and other plant, for the urban district council.—Mr. W. E. Kidner, acting engineer and manager, Electricity Works, East-street, Barking.

HULL.—July 22nd.—For the supply of turbo-alternator and a condenser outfit, for the corporation.—Mr. T. G. Milner, city treasurer, Guildhall, Hull.

Roads.

BROADSTAIRS.—July 12th.—For the supply of 90 tons of granite macadam broken to a 2-in. gauge, for the urban district council.—Mr. H. Hurd, surveyor, Council Offices.

BUNGAY.—July 14th.—For the supply of Mountsorrel granite, for the urban district council.—Mr. E. Earl, surveyor.

FULHAM.—July 14th.—For making up and paving Bowfell-road, for the borough council.—Mr. F. Wood, borough surveyor, Town Hall.

SHEFFIELD.—July 15th.—For asphalting at council schools, for the Education Committee.—City Architect, Town Hall.

DURHAM.—July 19th.—For excavating, providing and laying reinforced-concrete foundations, and paving with granite setts on certain sections of main roads, for the county council.—Mr. Albert E. Brookes, county engineer and surveyor, Shire Hall, Durham.

WANDSWORTH.—July 19th.—For making up and paving part of Emsworth-street, Streatham, for the borough council.—Mr. P. Dodd, borough engineer, 56 East-street, Wandsworth.

TUNBRIDGE WELLS.—July 20th.—For the supply of 1,100 tons of granite or hard limestone chippings for road tarring, ⅜-in. to ¾-in. gauge, for the corporation.—Mr. W. H. Maxwell, borough engineer.

TWICKENHAM.—July 21st.—For making up a street, for the urban district council.—Mr. F. W. Pearce, surveyor, Town Hall.

SCUNTHORPE.—July 26th.—For the supply of any quantity up to 400 tons of broken granite of approved quality, for the urban district council.—Mr. Herbert Heap, engineer and surveyor.

Sanitary.

ROYTON.—July 12th.—For the construction of a 12-in. pipe sewer, for the urban district council.—The Surveyor.

ADWICK-LE-STREET.—July 14th.—For scavenging the district, for the urban district council.—Mr. G. Gledhill, surveyor, Old School, Adwick-le-Street, Doncaster.

SMALLBURGH.—July 15th.—For work of scavenging, for the rural district council.—Mr. F. Davies, clerk, North Walsham.

WEST RIDING.—July 17th.—For the construction of 309 lin. yds. of pipe drain, for the Highways Committee.—Mr. F. G. Carpenter, West Riding surveyor, County Hall, Wakefield.

ETON.—July 19th.—For scavenging work, for the rural district council.—Mr. C. P. Summerhayes, Fairview Villas, Colnbrook.

HAMILTON.—July 26th.—For the supply and installation of sanitary fittings and laundry and washhouse plant, for the Middle Ward District Committee.—Messrs. Sydney Mitchell & Wilson, architects, 13 Young-street, Edinburgh.

HOWDEN.—For laying sewer and manholes, for the rural district council.—Mr. T. Dinsdale, Hailgate, Howden.

BILLERICAY.—For the collection of house refuse, for the rural district council.—Mr. S. J. Shelley, Junction-road, South Weald.

Miscellaneous.

GODSTONE.—July 28th.—For the supply of 250 tons of Linby best hand-picked hard steam coal, for the rural district council.—Mr. Geo. E. Crowter, surveyor, High-street, Godstone.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JULY.

10. Association of Managers of Sewage Disposal Works: Annual Summer Conference at Leeds.

14.—Royal Sanitary Institute: Meeting at Yeovil. Discussion on "Water Supplies to Rural and Small Urban Areas."

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. JULY 16, 1915. No. 1,226.

Minutes of Proceedings.

Association of Managers of Sewage Disposal Works: Presidential Address.

One of the matters on which managers of sewage disposal works are to be congratulated is the choice of the presidents of their association. On the other hand, this association is so well managed, and is increasing in importance to such an extent, that it is a worthy honour to be elected as its president. We therefore have no hesitation in offering our congratulations both to the association on their choice and to Dr. Maclean Wilson on his election as president of the association for the coming year. Having regard to the official position occupied by Dr. Wilson in the West Riding of Yorkshire, the compliment which has been paid to him is probably unique, although those who are acquainted with him will certainly recognise it as none the less well deserved.

On an occasion of this kind an address of special interest is anticipated, and a perusal of the presidential address, which is printed on another page, will show that all expectations have been fulfilled. No attempt was made to cover the whole of the subject. The main portion of the address was devoted to three points which are of the greatest interest at the present time. While still unable to state that the sludge problem has been solved, Dr. Maclean Wilson was in a position to refer to several of the latest developments in dealing with sludge which have proved successful in principle, and to express the opinion that sufficient progress has been made to justify the hope that the problem is now nearing a solution. Among the several systems mentioned in the address, that known as the "S. O. S." has already produced results which, we believe, afford good prospects of disposing in an economical and sanitary manner of the large quantities of sludge daily produced in many towns. We agree with Dr. Maclean Wilson that the crux of the whole matter is the cost of the process compared with the price of the product, and from what we have seen of the latest improved form of this plant we believe it will be found satisfactory in this respect. Further details as to the cost of operation are, however, necessary before a definite conclusion can be arrived at.

In dealing with this subject, the new president has assumed that sludge must always be produced, and that "it is usually in a very unmanageable form, too often in a wet, pasty mass, unpleasant to handle, and difficult to use with advantage." He has, however, omitted all reference to the one system in which the quantity of the sludge, as well as the objectionable features mentioned above, are reduced to the minimum. We refer to the Dibdin system of slate beds. From our own experience of this method of treatment we believe that the sludge produced in properly-designed and well-managed slate beds must bear a close resemblance to the final result obtained by the "activated" sludge process, which is described later in the same address. It will be remembered that Mr. Dibdin some years ago described the deposit in the slate beds as "live" earth, which corresponds closely with the term "activated" sludge. So far as we can judge, the chief difference between the two systems lies in the method by which the necessary supply of oxygen is obtained. In the one case it is drawn from the air by natural means without cost, while in the other it is provided by artificial aëration at considerable cost for power. On the other hand, the "activated" sludge process may involve less initial expense for the construction of the necessary works, and in a number of places it is possible that existing tanks may be adapted at a slight outlay for alterations. In this matter, as in many others, it would be much better and fairer, as Dr. Maclean Wilson says, if there were a central authority to set up and test the various kinds of apparatus and to report the results, with all details of cost, for the information of the public at large. In the absence of such an authority, the co-operation of several authorities, in the manner adopted in one case in the United States, as recently reported in these columns, would be of great advantage. We venture to suggest that the new president of the association should utilise his year of office to continue the efforts he has already made in the West Riding in this direction, and we hope that he may ultimately be successful. On the question of the recommendations of the Royal Commission with regard to standards for effluents, Dr. Maclean Wilson speaks with authority and experience, and is very emphatic. The recommendations in question have not yet been put into legal force, and as there does not appear to be any likelihood of anything being done in the near future, there is ample time for the matter to be well considered.

* * *

Clay Subsoils.

The troubles of the rural road surveyor are generally due to want of the necessary funds to bring his roads into a sufficiently satisfactory condition to meet the increased wear and tear of modern motor traffic. When, in addition to this, he is troubled with a clay subsoil, as described by Mr. J. A. Webb in the paper which he submitted at the recent annual meeting of the Institution of Municipal and County Engineers, then his lot, like Gilbert's policeman, "is not a happy one." Clay, like peat, as a foundation is a source of great trouble, and in most cases the only satisfactory remedy is to take out the clay for a depth varying from 6 in. to 3 ft., as may be demanded by the weight of the traffic, difficulties of drainage, and other local circumstances, and replace it with a foundation of hard core, clinker or rubble, according to the facilities for getting one or other of these materials near the site of the work. Clay is soon reduced to a plastic condition by rain or subsoil water, and then, being practically of an

impervious character, it is somewhat difficult to drain. In a plastic condition the subsoil squeezes out, and the creeping of the foundation is followed by that of the sub-crust and surface of the road, which soon presents a corrugated appearance. Several remedies have been put forward for preventing this creeping, the most heroic, perhaps, being that by Mr. Sinnott, the county surveyor of Gloucester, as described by him last year at Cheltenham. This method, which Mr. Sinnott proposed to patent, was to put down a rigid concrete framing placed at a suitable depth below the surface of the roadway—usually about 6 in.

While everyone is agreed that the foundation on clay subsoils must be a strong one if sub-crust movement is to be avoided, there is a somewhat general agreement that a rigid framing in a roadway is undesirable, costly, and unnecessary, and that strong kerbs and a good hand-packed rubble foundation will generally get over the difficulty satisfactorily. Drainage is desirable in most cases, though hand-packed rubble is sufficiently open in most cases to allow the water to run off to the sides of the road, and then be connected by land drains to the ditches. The variations in the strength of existing roads and the need for trial holes being made in them was strikingly shown in diagrams given in the paper read by Mr. G. H. Jack, the county surveyor of Hereford, at the recent National Road Conference in London. The diagrams showed clearly that in many cases the existing roads are sufficiently strong to stand without any further foundation, in others only part required strengthening, while in other cases a foundation 3 ft. deep is required for the whole width of the road. Mr. Webb appears to have overcome his difficulties by removing the clay subsoil in soft or weak spots and substituting hardcore. The hardcore is consolidated with a 10-ton steam roller, and the surface is covered with granite coated with bituminised material. The value of a kerb and a channel to prevent creeping is pointed out by Mr. Webb, who found the same material laid on roads with grass verges creep badly shortly after the tar-macadam was laid.

Tar-macadam. The paper by Mr. N. Greenshields on "The Preparation and Laying of Tar-macadam on Roads in Bedford," which was discussed along with Mr. Webb's paper, dealt with a subject which most municipal engineers have at one time or another to tackle. The experiments carried out by Mr. Greenshields leads him to prefer slag to either granite or limestone for tar-macadam, though Mr. Webb in a neighbouring county finds that granite is the most satisfactory stone. Both gentlemen prefer hand mixed to machine mixed, and they prefer ordinary tar-macadam to tar-grouting. The use of any particular material for tar-macadam depends so largely on local conditions that they must be carefully considered before deciding which is the most suitable material. While many surveyors prefer slag to either granite or limestone, others prefer granite for heavy traffic and limestone for light traffic. The success or failure with any of these materials is chiefly due to the character of the tar used. So many successful roads have been made with each material that it is obviously not the stone which is at fault, but the consistency of the tar and the method of mixing. As Mr. Boulnois pointed out in the discussion—reported on another page of this issue—it is not always the materials which make a good road, but the skill with which they are applied. The large slag tar-macadam manufacturers are most careful in the selection of their materials, but much of the slag sold and used by small manufacturers is of a soft and unsatisfactory character. Granite is a much more reliable and generally a stronger and more durable material than slag, and when the large granite quarry owners bring the amount of care and skill to the manufacture of tar-macadam that the slag manufacturer does now it will prove a most reliable article.

Mr. Horton, of Derbyshire, prefers slag to either granite or limestone, while Mr. Wakelam thinks that granite is both stronger and better than the other two materials. Mr. Brodie, of Blackpool, has found that limestone has carried the traffic along his sea front satisfactorily for many years, and, although it is not so durable or dustless as granite, it makes a very good road for light traffic. Mr. Greenshields finds ordinary boiled gas-tar gave him satisfactory results, and many surveyors have a similar experience, though the proprietary tars are, as a rule, more dependable and consistent in quality. So much depends upon the position of the road, the amount of traffic, and the time of year that the tar is to be used, that it is difficult to standardise a tar which will be suitable for all situations and temperatures. Even in the mixing of the tar-macadam there is a great variation in the quantity of tar used by different surveyors and manufacturers. Mr. Greenshields gives the variation in his case as being from 8½ to 21 gallons per ton according to the size, and so forth, of the material being treated. While 8 gallons per ton is a usual quantity for a coarse bottom coat, 21 gallons per ton for a fine top coat is much above the average quantity used, and is likely to lead to an excess of tar, which will work up to the surface of the road under heavy traffic in summer. Mr. Webb's experiments with tar-grouting, and with Mr. Gladwell's system, were not very satisfactory, and, though both systems have been fairly successful in many parts of the country, the opinion of the majority of surveyors appears to be that a properly mixed tar-macadam is superior to both these methods, and is not more costly.

* * *

Public Health in Marylebone. Among the many activities of the public health department of the Metropolitan Borough of St. Marylebone, as detailed in the recently issued annual report of Dr. Porter, the medical officer of health, we are specially impressed with the progress that has been made with the house-to-house inspection of the district for the purposes of the Housing, Town Planning, &c., Act, 1909. The procedure adopted is to have these inspections carried out in the first instance by a house-to-house inspector, whose duty it is to make and keep records of his inspections and to refer defective premises to the medical officer of health and sanitary inspector to be dealt with as each case may require. The fact that during the year it was found necessary to make only one new closing order was largely due to the adoption of the practice of communicating with owners in all cases in which it seemed necessary to do something more than could be called for by the usual nuisance notices, before making a report or representation to the Public Health Committee. Such a practice, we are convinced, makes for the smooth working and efficient administration of the Act, and we are not surprised to find in the report a statement that owners always showed themselves to be willing to meet the medical officer of health or the inspector and discuss matters, and improvements of real value were undoubtedly obtained because the necessity for them and the methods by which they could be brought about were discussed in a friendly way. In two cases owners availed themselves of their statutory right of appeal to the Local Government Board against closing orders. The first appeal was dismissed, and in regard to the second the board stated a case for the opinion of the High Court, asking for guidance on two points—viz., as to whether or not the premises

were back to back houses within the meaning of the Act; and whether, having been erected for chauffeurs, they were intended for occupation by the working classes. The decision of the High Court has now been given, and has been noted in these columns, but the board had not made their order on the appeal at the end of the year with which the report now under notice is concerned. The standard of the general work of the public health department is reflected in the low death-rate—namely, 14·9 per 1,000—and the low rate of infantile mortality, which was 98·6 per 1,000 births.

* * *

Road Board Funds and the War.

Mr. Harold Cox, writing in the *Sunday Times* on "The Crime of Extravagance," alludes among many other "horrible examples" to the subject of the Road Improvement Fund, which he states is estimated to absorb in the present year no less than £1,431,000. "This fund," he writes, "is derived from special taxation falling upon owners of motor-cars, and is devoted to the improvement of the roads for the benefit of motor traffic. In time of peace that was a justifiable expenditure, but in time of war not only is it a crime to spend money on road improvement, but it is also, according to Mr. McKenna himself, a crime to spend money on private motors at all. Therefore this fund ought at once to be diverted to war purposes." Mr. Cox writes with so much whole-heartedness and zeal that we doubt whether he will be grateful to us for pointing out that a proportion of the Road Board moneys is already being expended for the purposes of the war. Sir George Gibb, chairman of the board, in a speech recently at the annual dinner of the Institution of Municipal and County Engineers, said: "Without doubt the special traffic due to the war had affected a good many of the roads, and questions had arisen, and would continue to arise, as to the effect of this extraordinary traffic. An arrangement was made by the War Office that the Road Board should act as a sort of intermediary between the local authorities and the War Office to deal with the question, and carry out a good many improvements that were required in order to strengthen roads that might be used for military purposes, and already they had spent on work—which, of course, was of benefit to the local authorities of the areas concerned—nearly £500,000, the board in some cases contributing to the expenditure; but they had been very careful not to allow the Road Board funds to be diverted to any work which could not be justified as a work of permanent public improvement for the purposes of ordinary traffic." This may, of course, savour too much of the prosaic and cautious to suit the enthusiasm of Mr. Cox for something heroic, but it ought not to be necessary to suggest to a professed economist that the remedy he proposes would only mean the suspension of important and necessary works to the great detriment of the public roads and the interests of the country at large.

* * *

Sewage Disposal at Philadelphia.

We have now received the complete report prepared by the chief engineer of the city of Philadelphia and his assistants, and dealing with the methods to be adopted for protecting the public health by maintaining the rivers as fit sources of water supply, for providing for the comfort of the citizens by restoring the sewage-laden streams to a clean condition, and for improving the port by providing a clean sanitary harbour. The result is that recommendations are made for the interception of the sewage, which at present flows direct into the river and harbour, and treating it in such a manner that the effluent can be disposed of by dilution in the river and tidal waters without creating a nuisance. The execution of the works proposed will involve an expenditure of £1,000,000 annually for the next five years, and the provision of sites for additional works of purification which will be required later to meet the conditions which it is estimated will exist in the year 1950.

A considerable length of main collecting sewers is proposed, as well as three separate disposal works for different sections of the city. The preliminary treatment recommended is screens and grit chambers, followed by fine screens only in one case, and in the other two cases screens and grit chambers followed by Imhoff tanks, to which it is anticipated that percolating filters will have to be added as the population increases. Very careful investigations have been made, including calculations of the prospective requirements of the city, sanitary surveys of the rivers, and an examination by one of the assistant engineers of the various systems of sewage treatment in use in Europe. The report is well illustrated by reproductions from photographs, maps, and diagrams, and the authors deserve every credit for the able manner in which it has been prepared and issued for the benefit of the public at large.

* * *

Air-raid Precautions.

It is matter of common knowledge that steps are being taken, by the erection of some substantial covering over roofs, to protect many of the large commercial buildings in the City of London against damage from possible attacks by hostile aircraft. In some summonses that were recently heard at the Guildhall the question was raised as to whether notice should be given to the district surveyor before such work is begun. It was pointed out by the defendants that the work was essentially of an urgent character, and was designed not only to secure the safety of the building, but so that it would also incidentally act as a safeguard to the public. It was, nevertheless, held that a technical offence had been committed, and a nominal fine of 5s. was imposed. This appears to us to have been a very reasonable decision, for while on the one hand the principle was established that the district surveyor is entitled to notice—from which it follows that the work must be carried out under proper supervision—on the other hand the owner, who was concerned in part, at any rate, to secure the safety of the public, was not unduly penalised for his technical breach of the law. In a time of crisis like the present it behoves officials and public alike to be as reasonable as possible in their attitude towards each other.

* * *

Surveyor or Foreman?

Three candidates were recently selected from among the applicants for the appointment of highway surveyor for the eastern district under the Southmolton Rural District Council. As the salary offered was the small one of £85 per annum, we were naturally interested to see what kind of applicant was attracted, and we now find that of the three placed on the short list two were actually engaged as foremen, while the third was acting as a valuation officer. What is the significance of this? It may mean that such a small salary fails to attract the properly qualified surveyor; or, on the other hand, it may mean that he applies in vain. In any case, the result is that the council have appointed a foreman at the wages of a foreman, and perhaps it matters little that he is styled a "highway surveyor." We understand that Southmolton is a very large district situated partly on Exmoor, and that the highway surveyor is expected to provide his own means of conveyance—facts which go a long way towards depreciating the actual value of the very moderate wage offered. It would seem, therefore, that the unsuccessful candidates have not very much to grieve over.

Road Maintenance in Herefordshire.

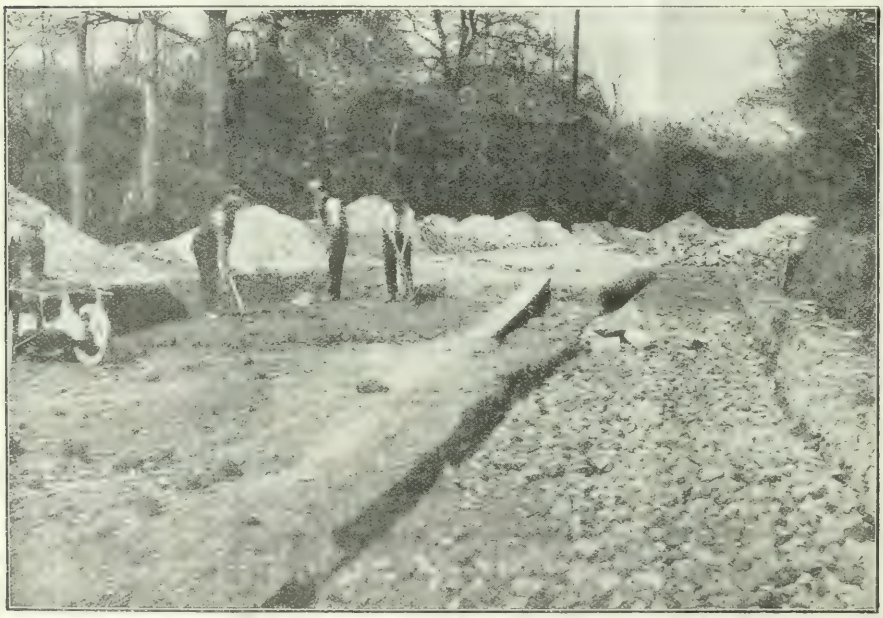
In his eighth report on the main roads and bridges under his control, Mr. G. H. Jack, the county surveyor of Herefordshire, states that the roads—the present length of which is 501¼ miles—suffered a good deal of deterioration during the exceptionally wet autumn. Apart from this the general condition remains about the same as in the previous year. The trunk roads present increasing difficulties each year, and the need of bituminous surfaces for the whole length of such roads is more and more apparent. Mr. Jack feels that these roads will never be satisfactorily maintained until definite lengths are under the control of competent foremen whose duty it should be to be continually on the length. "This is," he observes, "the only method by which timely repairs can be executed and costly surface work saved from early destruction. If some such method is not adopted there is great danger of a considerable waste of money on tarred roads, which are known to need skilled attention in order to secure the benefits of longer life and easy traction. There is no doubt in my mind that tarred roads badly managed are more troublesome than the old water-bound roads."

In some remarks upon the trunk roads, Mr. Jack mentions the reconstruction of Dinmore Hill, on the Hereford-Ludlow road. Heavy foundations, some drainage, and a new surface have been laid for a distance of 3,880 yds., covering an area of 28,085 sq. yds. The accompanying illustrations—reproduced by the courtesy of the county surveyor—will give a good idea of the nature of the work in its various stages. This undertaking presented many difficulties; its extent may be gauged by the fact that no less than 8,487 tons of stone were used in the foundations and 3,916 tons upon the surface. During the progress of the work it was discovered that hundreds of tons of stone had been used in the past to no good purpose, inasmuch as it was simply squeezed into the clay by the traffic, and thus lost.

The total amount of work accomplished under the road reconstruction scheme to March 31st last was: Foundations, 170,303 sq. yds. (25,351 tons); surface 94,489 sq. yds. (13,876 tons). Taking the average width of the roads at 6 yds., 16 miles of foundation and 9 miles of surface were completed.

The outbreak of war has practically put a stop to the work, which in ordinary times would have been quite finished during 1915. Not only has the work been disorganised, but the ultimate cost will be seriously affected. The dislocation rather seriously affects the work in this way: Many miles of completed foundations should be surfaced this year. This being impossible, it becomes necessary to take some steps to preserve the work until the surface can be applied. Mr. Jack proposes to tar-paint these foundations as the only means of preventing deterioration, and his action has been approved by the Road Board's engineer.

On the whole very few complaints from road users have been received during the time the new work was in progress. There have, however, been some complaints as to alleged dilatoriness of the workmen.



Reconstruction of Dinmore Hill, Hereford-Ludlow Road.

(Shows the large amount of soft clay removed prior to application of foundation material.)

Upon investigation, Mr. Jack found that in every case the delay was mostly due to transport and supply difficulties.

The life of the new roads was estimated at seven years. Mr. Jack has every reason to believe that, provided ordinary circumstances prevail, this will be found fairly correct. "It is quite certain, however," he adds, "that very considerable saving in expense will be realised in the maintenance of roads such as Dinmore, where the new foundations will prevent the annual loss of much valuable metalling. It is a mistake, however, to imagine that modern roads require no attention whatever. The surface coatings are sure to give way in places owing to the impossibility of securing uniform density and quality of material. These places need the attention of skilled men as soon as defects become apparent."

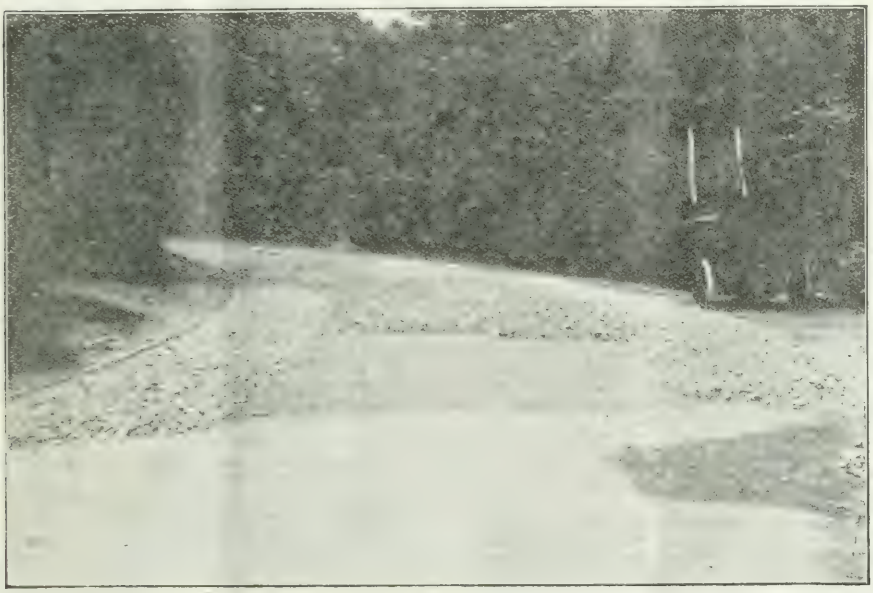
An interesting work.

An important work undertaken during the year was the restoration of Wilton Bridge over the Wye at Ross. This bridge was built in 1599, and since that date has undergone very little repair. Traction

engine traffic seriously shook the structure, so that apart from work of repair it was necessary materially to strengthen the bridge. This was done by the insertion of a "longitudinal girder," which acts as a support for the parapets independently of the ancient masonry, and also braces the whole structure, so

NATIONAL ROAD CONFERENCE.

The subject of the classification of roads, introduced by Mr. G. Montagu Harris, the secretary of the County Councils Association, was considered at the third sitting of the recent National Road Conference in



DINMORE HILL RECONSTRUCTION.

(The surface coat—gore stone in centre, limestone at sides. On some stretches Clee Hill stone was used in the centre.)

DINMORE HILL RECONSTRUCTION.

Hot asphalt applied to the surface to protect the metalling and prevent dustiness.)

that to-day the bridge is stronger than ever it was. This work has been accomplished without interfering in any way with the appearance of one of the most picturesque bridges in England.

London. A considerable instalment of Mr. Harris's important paper is reproduced elsewhere in this issue, and the remainder will appear next week, together with a report of the discussion.

Association of Managers of Sewage Disposal Works.

DR. MACLEAN WILSON'S PRESIDENTIAL ADDRESS.

[On the occasion of his installation last Saturday, at Leeds, as president of the Association of Managers of Sewage Disposal Works, Dr. H. Maclean Wilson, chief inspector to the West Riding of Yorkshire Rivers Board, delivered the subjoined address.]

My first duty in addressing you is to thank you for the honour you have paid me in electing me your president. I esteem it highly, as your association is one which at present holds a high position, and will, I am confident, be still more important in the near future.

I have also a more personal reason for appreciating the honour you have done me, for, as you are aware, much of my work is to keep watch upon the doings of your members, and every now and then to invoke the powers of my board, or even of the law courts, against them. That you have placed me where I am to-day shows that these powers have not been used arbitrarily or harshly. I have, indeed, many friends among your members, and I would like to take this opportunity of publicly thanking the sewage works managers of the West Riding for their invariable courtesy and assistance.

Like every one of my predecessors in this chair, I have had some difficulty in fixing on a subject upon which to address you. I am old enough to be reminiscent, as it is now twenty-four years since I first devoted myself entirely to public health works, but I will spare you, except to say how well I recognise the great change that has taken place during my time in the class of men employed as sewage works managers and in the manner in which their duties are performed.

In the early days of my work there were comparatively few sewage works in existence. No one took any interest in them, and the management was too often supposed to be an easy business which might be left to some old roadman, too old to keep the roads in order. I need not tell you that this state of matters is altogether changed. Sanitary authorities are every day recognising more fully that their sewage works are a very important part of their sanitary equipment, and the standard expected of a sewage works manager is year by year becoming more stringent.

Fifteen or twenty years ago the manager was almost expected to do his best to hoodwink the Rivers Board inspector and everyone else concerned with the purity of his effluent, and you will know what a deterioration in personal character and in the standard of work this led to. I am sure that there are few, if any of you, now who are not wise enough to recognise that it is your duty to make the best of the means of sewage purification entrusted to your care, and the worst possible policy, besides being dishonest, to attempt to hide defects of your works by trickery.

The best results of an association such as yours is that it evolves men who are incapable of such underhand work.

May I claim to have done something to assist in bringing this about? Those of you who belong to the West Riding will, I am sure, acknowledge that the Rivers Board has never attempted to blame a manager whose works were insufficient, so long as he was making the best possible use of them. The board has always striven to distinguish as clearly as possible between defects of management and insufficiency of works, and the board's officials have continually worked in conjunction with the managers in suggesting to the authorities and pressing upon their notice any improvements or extensions required.

One further note and I have done with this part of my subject. One common defect in the management of sewage works, partly the fault of the manager, partly because the authorities will not give the necessary money, is that the sewage works are too often untidy and rough. I have visited many sewage works on the Continent, and have found there that much more attention is paid to the appearance of the works. The pathways are kept clean, the grass banks properly cut, and trees and shrubs are planted, so that it is really a pleasure to inspect them. On discussing this with friends on the Continent, they have said that they also have noted the difference between works here and abroad, and attributed the tidiness and better appearance of their works to the military training which every one of the managers had undergone. Now, I have all my life been an advocate for universal military training, and I am sure, from the change you have seen in some of our young men during the last few months, you will recognise that it would tend to get rid of much of the slouching and slovenliness which are only too common. When such a training is carried to an excess, as on the Continent, it has its disadvantages, for, as one Continental expert told me, he quite recognised that a manager of sewage works there was neat and tidy, and always ready to carry out orders with the utmost precision; but, he said, one is much more likely to get from your English manager an intelligent appreciation of the works under his care, and valuable hints for their improvement, because he is of a more independent turn of mind and more accustomed to think things out for himself.

As I said, I am not inclined to trouble you with any more reminiscences. I would rather deal with subjects which are of interest for the future, and the three most important are I am sure—

(1) The sludge problem;

(2) The standards for effluents recommended by the Royal Commission; and

(3) The new method of sewage purification by means of activated sludge and aëration.

THE SLUDGE PROBLEM.

The purification of sewage is now so well proved by experience that we know it is possible to obtain an effluent of any desired degree of purity; but all methods of purification are handicapped by the problem of dealing with the solid matters which sewage contains, and which must be separated in the form of sludge before the liquid can be purified.

This problem cannot yet be said to be solved, although many attempts at the solution have been made. The Royal Commission on Sewage Disposal in their Fifth Report state that it is one of the chief difficulties in dealing with sewage, and add that probably it will always remain so. With this latter opinion I do not agree, especially in view of the developments that have taken place during the seven years since the date of their report.

Sludge contains very valuable manurial substances, and it has been a constant theme with chemists from the time of Liebig that for the most part these valuable substances, for which the soil is crying out, have been wasted. The Royal Commission had several series of experiments conducted upon the practical value of sludge as a manure, but these experiments were by no means conclusive. Contrary to the results obtained by the commission, you have all of you noticed the excellent crops obtained after the use of sludge under suitable conditions, and I am sure that you will agree that its effect is much more marked than the experiments of the commission would lead one to suppose.

It appears to me that the chief difficulty preventing a ready sale of sludge is that it is usually in a very unmanageable form, too often in a wet, pasty mass, unpleasant to handle and difficult to use with advantage; and the sludge problem seems to be the discovery of the best and most economical methods of preparing it in marketable form and the recovery of the valuable substances it contains.

For sewage works which are too small for the installation and working of an expensive plant, the best method of dealing with sludge is to dry it upon a properly constructed sludge filter, and while you are in Yorkshire I should advise you to see the sludge filters at Guiseley sewage works, devised by the manager there. To describe them briefly, they are constructed with a concrete floor sloped to a central channel. Upon the floor is laid stone pitching about 9 in. in depth, and all directed towards the central channel. On the top of the stone pitching graded clinkers are placed to the depth of some 9 in., with a surface layer of very fine clinker, just free from dust; any supernatant water which separates from the sludge immediately is run off by an

arrangement of perforated pipes by the side of the filter. Such a filter, if properly cleansed after each dose of sludge, is very lasting, and some of those at Grassby have been in use for twenty years.

Sludge when put upon such a filter will, in dry weather, part with its water very rapidly, drying up in less than a week, so it can easily be removed by spade. If sludge in this condition is set aside on a spare piece of ground it will, in favourable weather, soon become so dry that it can be removed and spread upon the land without inconvenience.

To deal with sludge in this manner, however, is only advisable for small sewage works. Where large quantities have to be disposed of, other methods of disposal have to be sought, and during the last few years several works for the preparation of sludge in a convenient form, and for the recovery of by-products from it, have been installed with very promising prospects of success.

Probably the chief objections to the use of sludge in its ordinary form are the moisture and grease it contains. The former adds greatly to the cost of carriage, for with sludge of 70 per cent moisture, 7 tons of water have to be handled along with every 3 tons of solid matter; it also makes the proper distribution of the sludge upon land very difficult. The latter hinders the decomposition of the sludge on the land, and tends to choke up the pores of the soil. A third, but minor objection, is that sludge, especially from semi-rural districts, frequently contains the seeds of weeds which the farmer objects to introduce in his fields. The new methods of preparation of sludge are directed, intentionally or otherwise, towards getting rid of these objectionable features.

One most successful method on a large scale is that of Mr. Garfield at Bradford, where, by treatment with sulphuric acid and hot pressing, he extracts grease from the sludge and leaves a fairly dry cake, which is powdered and sold to manure merchants. The process at Bradford is very profitable, but as it is only available for sludges which contain very high percentages of grease it is not of very general interest.

Dr. Grossman, at Oldham, has for some time been using a process in which he reduces the moisture in the sludge by treatment with sulphuric acid and secondary settlement, and afterwards dries the sludge and distils off grease in hot-air chambers. This recovers all the grease and leaves the residue in the form of a valuable dry powder. As at Oldham, there is practically no trade refuse in the sewage, and as the process is said to yield some profit, it is well worthy of general consideration.

At Dublin the sludge with the addition of yeast is fermented and settled for the removal of water, and afterwards dried in an excellent drier, so that it is obtained as a dry powder, which, it is said, can be sold at a considerable profit. Some doubts have been thrown upon the efficacy of the yeast treatment of the sludge and upon the value of the resulting powder, and further tests in these two directions are certainly required. Mr. Watson is, I understand, at present having a complete plant of this kind erected at Birmingham.

At Tadcaster the B.T.W. apparatus for drying sludge has been in use for some considerable time. It also reduces the sludge to the powder form, and is simple in construction and easy of manipulation.

The drying of sludge, if done by means of coal as a fuel, is a costly operation. With coal at 10s. per ton, the cost of drying is probably not less than 8s. per ton of powder produced, although this expense for coal can be avoided in many cases by using the heat produced by a destructor, and the plant at Tadcaster has been devised to this end.

It is doubtful whether a price much higher than this can be got for ordinary dry sludge. But after the sludge is dried it is comparatively easy to extract the grease it contains, as Dr. Grossman has done, and other experimenters have directed their endeavours in this direction.

At Norwich a plant has been introduced for drying the sludge, and afterwards extracting grease from it by means of a solvent, and at Huddersfield a similar plant is now successfully at work.

At Wimbledon the "S.O.S." Company are erecting a plant to deal with all the sludge of the town, in which they dry it, distil off grease and ammoniacal liquor by means of hot gases, and continue the distillation until gas and pitch are produced, leaving a carbonaceous residue which is said to be useful in the precipitation of sewage, especially if a precipitant has been used in treating the sewage in the first instance. The gas evolved from the sludge is said to be sufficient for its distillation, so that an expensive coal bill is avoided.

These various processes have been in use for such a length of time, and on such a large scale, that it can now definitely be said that they are successful in principle. The crux of the whole matter is the cost of any of the processes compared with the price of the product, and it is to be hoped that the various experimenters will publish full details, without which no conclusion as to the advisability of the processes can be arrived at. The progress made has been sufficient to justify the hope that the sludge problem is now nearing a solution.

What is happening in the discovery of the best method of dealing with sludge furnishes strong evidence in favour of the recommendation of the Royal Commission on Sewage Disposal that a central authority should be established to deal with such matters. At present every town makes its own costly experiments, and the results are only available for other towns through the courtesy and communicativeness of the responsible officials. It would be much better and fairer if there were a central authority to set up and test various kinds of apparatus, and to report the results, with all details of cost, for the information of the public at large. I have tried in vain in the West Riding to induce some of the county boroughs to share the expense of experiments of this kind, hoping that at various sewage works the different processes might be tried on a working scale, and directly under the supervision of the sewage works managers, so that reliable results as to the working of these processes and their cost might be made available.

STANDARDS FOR EFFLUENTS RECOMMENDED BY THE ROYAL COMMISSION.

You have no doubt studied the Eighth Report of the Royal Commission on Sewage Disposal, and its recommendation that legal standards for sewage effluents should be prescribed. In coming to this conclusion the commission, it may be suggested, decided against the weight of evidence which was placed before them, and certainly went contrary to the opinion of many well qualified to judge.

In 1907 they issued a circular to a large number of persons asking for their opinions and suggestions, and it is interesting to note that, without exception, all the officers of the rivers authorities, including county councils, who replied stated that they did not think it was practicable to fix legal standards. This is significant, as it would obviously be to the advantage of these officers, and would simplify their work, if such standards were practicable.

Since the report of the Royal Commission was published, the Association of Municipal Corporations appointed representatives, selected for their skill and experience in the design and maintenance of sewage disposal works, to consider the recommendations of the commission. This committee were in complete agreement that it is not desirable that standards of purity should be prescribed by Parliament as the Royal Commission recommends. I feel sure that, on careful consideration of these views, and of the reasons which gave rise to them, you will also come to the conclusion that the Royal Commission has made a mistake. My own view is that, if proceedings are taken against any person or authority for discharging polluting sewage effluents into a stream, and if there is any disagreement with regard to the amount of purification necessary, it should be open to the defendants to appeal to a central authority on the ground that they are using the best practicable and reasonably available means to purify the sewage.

If the standards suggested by the Royal Commission should ever become legal, their effect on the sewage works manager would only be slight, for he would still have to utilise to the best advantage the means at his disposal, and I do not know of any case where such means are likely to be in excess of the requirements.

The general standard suggested is, perhaps, rather more stringent than the working standards of comparison which have long been used by the various rivers authorities. These have no legal weight, but are only guides to show what authorities could accomplish in the purification of their sewage if they were to adopt the best practicable and reasonably available means.

Cases in which a relaxation of the general standard could be claimed, on account of dilution or some other ground, will not be many, especially as members of the commission have stated that it never was their

attention that any relaxation should be granted in such districts as the West Riding.

The test for the consumption of dissolved oxygen, upon which the proposed standards depend, is not one to be recommended, even when in the hands of skilled chemists. The results obtained by them are frequently discordant, and the sewage works manager who is not a skilled chemist will be well advised not to attempt the necessary analysis.

THE PURIFICATION OF SEWAGE BY AERATION IN PRESENCE OF ACTIVATED SLUDGE.

You have so frequently of late been addressed upon this subject that I need discuss it only very generally. The process is a development of methods previously in use.

In 1869 Prof. Frankland made many experiments on the filtration of sewage through sand, and apparently looked upon the purification he obtained as the result of a purely chemical process of oxidation.

In 1887 Mr. Dibdin, in a paper read before the Institution of Civil Engineers, drew attention to the fact that the process of purification depends on micro-organisms, and here at Leeds, in 1897, insisted that the free supply of oxygen is necessary for the life of many of the most important of these organisms.

About the same time, in the course of the experiments then being carried out at Knostrop, it was found that fresh crude sewage can be purified on biological filters at a wonderfully rapid rate—within a quarter of an hour—when passed through screens and double percolating filters. This showed that the solids must be separated from the liquid with extraordinary rapidity, and gave rise to the view that among the agents at work must be enzymes secreted by the micro-organisms, and similar to others met with in the process of digestion.

In 1902 Prof. Dunbar and Dr. Thumm drew special attention to the living slime which coats the material of a biological filter, and showed that this was largely responsible for the purifying action.

It was thought that they might be found in humus obtained from the effluent of a percolating filter, and that the humus might therefore be useful in coagulating and separating the organic matters in sewage just as rennet clots the curds in milk. In 1908 some experiments were carried out in the laboratory of the Rivers Board to test this theory, and it was found that sewage shaken up with humus and settled did become clarified to an appreciable extent. When this experiment was tried, however, on a large scale at sewage works the results were negligible. It evidently, in the light of further knowledge, failed for want of the necessary supplies of oxygen.

Meanwhile many investigators had been trying the effect of continuous aëration of sewage, most of them having apparently in view the direct chemical oxidation of the organic matters; but in 1912 Messrs. Clark and Gage, of the Massachusetts State Board of Health, in experiments on the aëration of sewage in a tank containing slabs of slate, found that the slate became covered with a compact brown layer which separated out both the suspended solids and the colloidal matters of sewage.

In 1912 Dr. Fowler found that a special organism, which he called M7, in the presence of a little iron salt and plenty of air, was capable of clarifying sewage very rapidly.

Finally, in the beginning of last year, Messrs. Ardern and Lockett evolved the process of purification of sewage by means of activated sludge in the presence of abundance of air, which was described to you by Mr. Ardern at your last annual meeting.

The process appears to depend upon a few principal factors—the presence of active organisms and the enzymes they produce, the enormous surface area available for the growth of the organisms furnished by the particles of sludge, an agglomeration of the solid particles such as takes place in the well-known Archbutt-Deeley system of precipitation, and an unlimited supply of oxygen to favour the growth of the proper organisms, and to oxidise the products of their action.

The results of the experiments at Manchester have been corroborated by those obtained at Salford, Wakefield, and many other places, and it can now be definitely said that by this method of sewage purification an excellent effluent can be obtained fit to be discharged into any stream. The sludge produced by this treatment is a much more valuable article than ordinary sludge, containing in many cases 4 or 5 per cent of nitrogen, and being in a condition in which it is easily dried. There are disadvantages as well, the principal being that the process requires very skilled supervision, and seems likely to be easily upset by sudden rushes of storm water or discharges of trade refuse, and when upset takes some time to re-establish.

With regard to this method of sewage purification, therefore, the same view may be taken as was advocated in the case of the sludge problem. It is undoubtedly successful in principle, and will yield satisfactory effluents. It remains to be proved what the necessary works and their upkeep will cost, and it seems at present very doubtful if this will be much less than the cost of works which are at present successfully in use. The new method may be found exceedingly useful when the extension of existing works has to be undertaken, but it would certainly be foolish to imagine that a panacea for all troubles of sewage purification has been discovered, and that works designed for older methods are to be scrapped. It seems very unlikely that the process will be found suitable for any but the larger works, and before it can be recommended for them the question of cost must be settled.

We are all, gentlemen, students, and I hope will continue to be so while we live. From what I have had to say to you under these three heads you will, I am sure, be convinced that we are students of a living science. Ancient it is, for we can study it in the writings of Moses, but our knowledge of it increases year by year, and there never was a time when there was such a prospect of near and important developments. All honour to the experimenters who furnish us with new ideas, and to the men who carry them to a successful issue.

I wish, gentlemen, again to thank you for the honour you have done me in placing me in this chair, and to offer you a very hearty welcome to the West Riding. Here you will find in use almost every known method of sewage disposal, including the very old plan of dumping it in the garden, which is recommended in certain cases by the commission in their Final Report, and of discharging it into streams, as was enforced by law in 1847, under some conditions, examples of sewage farms, good, bad, and indifferent, of chemical precipitation and septic tanks, and of all the known methods of biological treatment, including the latest, by means of activated sludge. You will be able, I am sure, to come to the conclusion that there is no one method which is to be advocated in all cases, and that, however good the apparatus provided may be, it is of very little use without a conscientious, hard-working, and intelligent sewage works manager.

SEWAGE WORKS MANAGERS AT LEEDS.

When Dr. Maclean Wilson rose to deliver the foregoing presidential address in the council chamber of Leeds Town Hall last Saturday morning there were present, in addition to the lord mayor of the city (Mr. E. Bedford), Alderman Rothwell (Bury), Councillors R. W. Oddy (Rochdale), G. Clark (Chesterfield), Frost (Macclesfield), W. Rothwell (Ashton-under-Lyne), Chantler (Manchester), Cundiff and Mosten (Manchester), Dr. Gilbert J. Fowler (Manchester), Messrs. S. S. Platt (Rochdale), H. Ledson (Rochdale), John Sheldrake (Ossett), W. Tomlinson (Chesterfield), J. E. Gaskell (Honley and South Crossland), W. Hartley (Whitwood), Joshua Bolton (Bury), Percy Gaunt (Macclesfield), James Kershaw (Rotherham), James Swithenbank (Pudsey), A. Applewhite (Lincoln), J. H. Garner (Huddersfield), Oscar J. Kirby (Batley), Allan Booth (Batley), W. H. Makepiece (Stoke-on-Trent), J. Rowbottom (Ashton-under-Lyne), E. Stamp (Ashton-under-Lyne), W. J. Ashley (Oldbury), Hugh Edwards (Withington), Thomas Barlow (Denton, Lancs), J. H. Barford (Maidenhead), J. H. Abbott (Chiswick), A. W. Reynolds (Stoke-on-Trent), Richard Giles (Burton-on-Trent), Chas. H. Ball (Davyhulme, Manchester), R. Tyson (Queensbury), R. Burton (Stoke-on-Trent), W. Cann (Fenton-on-Trent), J. W. Gaskell (Huddersfield), Chas. Hall (Droylsden), Chas. Griffiths (Droylsden), Oswald J. Wilkinson (Manchester), J. S. Lan (Haslingden), Jas. B. Ogden (New Hey), Daniel Ledson (Leigh), G. Fowler (Brighouse), Henry Burrows (Doncaster), C. F. Wike (Sheffield), Henry W. Stafford (Dukinfield), C. M. King (Barnsley), C. A. Okin (Worsborough), J. H. Lumb (Todmorden), F. Hambledon (Newcastle, Staffs), J. D. Brown (Consett), G. Ardern (Manchester), F. Morrison (Skipton), Norman Hale (Retford), Frank Naylor (Denby Dale), W. Hartley (Whitwood), Tom Gough (Spenborough), H. F. Calvert (Wakefield), G. W. Willis (Eccles), E. J. Silcock (Leeds), G. H. Nicholson (Bradford), G. Quick (Hanley), W. A. Duckworth (Salford), C. W. Appleyard (Sale), and J. W. Smith (Leigh).

In welcoming the members the LORD MAYOR, after referring to his personal interest in matters of sewage disposal, said the works at Knostrop, which they were to visit in the course of the day, had reached a stage in their progress which permitted of the methods of construction being studied to the best advantage. They would find several interesting innovations, and it was believed that when the plant was put into operation the city would be in possession of one of the most up-to-date undertakings of the kind in existence.

DR. MACLEAN WILSON, in returning thanks, said the members of the association were aware of the great interest the Lord Mayor took in the question of the purity of rivers, and the large amount of work he had done on the Rivers Board. They were glad to visit the city of Leeds because it had been noted for many years past for its experimental work in the biological treatment of sewage—work which had helped very materially in the elucidation of the problems that had confronted them.

A vote of thanks to Dr Maclean Wilson for his address was moved by Mr. RICHARD GILES (Burton-on-Trent), who remarked that the association had been very fortunate in a succession of presidents occupying high positions in the scientific world, who had always given to those concerned with the practical side of sewage disposal their help and sympathy.

Mr. GEO. A. HART (Leeds), in seconding, paid a warm tribute to Dr. Wilson, who, he felt sure, could be relied upon to fill the chair with distinction.

Mr. J. H. BARFORD (Maidenhead), supporting the vote of thanks, said he was deeply grateful to the Lord Mayor for the interest he had shown in the work of the institution, and for the very kind way in which he had received them. His lordship's interest in the work of sewage disposal was proved by the fact that he had given up a portion of his time that day to listen to Dr. Wilson's presidential address. If the sewage managers of the West Riding were to be envied for anything it was that they had a man like Dr. Wilson to look after them. The best friends he had ever had in connection with his work had been the Thames Conservancy Board. He could never understand why they, as sewage works managers, should attempt to dodge or trick the inspectors to such authorities. There had been, he knew, in the minds of many managers a sort of idea that if a sample was not up to standard it reflected on them; but that feeling could not exist in the minds of any of the men in the West Riding. All they had to do was to use their works efficiently, and if their works did not allow of the production of a satisfactory effluent they might take it that the blame would be on their authority, and not on them individually. The address which the president had given them was such that it must encourage them as managers to do the very best they could with the means at their disposal.

The vote of thanks was passed with acclamation.

In the course of the subsequent proceedings Mr. G. A. Hart, the sewerage engineer to the city, gave an interesting description of the works of main sewerage and sewage disposal embodied in the scheme authorised by the Leeds Corporation Act of 1908, and a paper entitled "Seven Years' Experience with a Large Sludge-pressing Plant" was afterwards presented by Mr. John T. Thompson, chemist and acting manager of the Knostrop works. Lack of space prevents our dealing with either of these this week, but we propose to give them in our next issue, together with an account of the discussion which followed.

After luncheon at the Victoria Hotel, the members drove in chars-à-banc to the outfall works, over which they were conducted by Mr. Hart and his assistants. On returning to the town hall they were the guests of the Lord Mayor at tea.

A Lowestoft Appointment.—Advertisements are about to be issued by Lowestoft Town Council for a certificated assistant sanitary inspector at a salary of £90, rising by £5 annually to £120 per annum.

Checking Water Waste.—At the last meeting of Lynn Town Council the waterworks engineer reported that during the recent dry weather the night consumption of water has been abnormally high. As a result of inspections made he found that in many cases garden hose and sprinklers are allowed to run all night, and that automatic flushing tanks which should be shut off at night are turned on too full. It was resolved that in future a charge of £1 per annum should be made for the use of garden hose, and that meter rates should be charged for all flushing tanks and fountains.

THE ROAD BOARD.

GRANTS TO HIGHWAY AUTHORITIES: NINETEENTH LIST.

During the months of April, May and June the Road Board indicated additional advances to highway authorities amounting in the aggregate to £109,903, of which £107,007 was by way of grant and £2,896 by way of loan.

The advances made and indicated up to June 30th, less indications cancelled, amount to £6,132,279. Of this total £4,685,753 is by way of grant and £1,446,526 by way of loan.

The formal grants completed, with the approval of the Treasury, during the last quarter, amounting to £125,847, were applied as follows:—

Road crust improvements	£123,045
Road widenings and improvement of curves and corners	419
Reconstruction and improvement of bridges	1,333
New roads and bridges	1,050

Areas of Highway Authorities.	Amount of grant for			
	Improvement of road-crusts.	Road widenings, corners and diversions.	New roads and bridges and reconstruction of bridges.	Total.
ENGLAND.	£	£	£	£
Bristol (C.B.)	262	—	—	262
Burnley (C.B.)	—	321		321
Cheshire	10,000	—	—	10,000
Cumberland	4,516	—		4,516
Durham	24,657	—	1,060	25,657
Essex	4,347	—	—	4,347
Exeter (C.B.)	—	150	—	150
Gloucester	5,867	—	—	5,867
Hertford	25		—	25
Isle of Ely	1,000	—	—	1,000
Lancashire	6,000	—	—	6,000
Leicester	2,467		—	2,467
Lines (Kesteven)	1,250	—	—	1,250
London (Area of the Metropolitan Police District)* ...	1,506	—	—	1,506
Monmouth	3,965	—	—	3,965
Norfolk	7,035	—	—	7,035
Northampton	3,462	—	—	3,462
Oxford	251	—	—	251
Soke of Peterborough ...	1,951	—	—	1,951
Somerset	1,500	—	—	1,500
Southampton ...	—	300		300
Surrey	—	—	1,383	1,383
Suffolk (East)	3,000	—	—	3,000
Suffolk (West) ...	16,952	—	—	16,952
Yorks (W.R.	6,943	—	—	6,943
WALES.				
Brecon	967	—	—	967
Carnarvon	1,500	100	—	1,600
Merioneth ...	412	—	—	412
Pembroke	250	—	—	250
SCOTLAND.				
Berwick	75	—	—	75
Dumfries	4,289	—	—	4,289
Dunbarton	435	—	—	435
Elgin	160	—	—	160
Fife	417	—	—	417
Lanark	2,100	—	—	2,100
Perth	152	—	—	152
Renfrew	2,250	—	—	2,250
Stirling	2,350	—	—	2,350
Wigtown	50	—	—	50
IRELAND.				
Cork (C.B.)	1,000		—	1,000
Wexford	41	—	—	41

*This includes £1,400 for authorities within the area of the County of London.

Motor Traffic in Stirlingshire. — Mr. William Ballantine, district road surveyor for East Stirlingshire, in his annual report to the Eastern District Committee of Stirling County Council, states that the ordinary motor traffic on the main roads in the district under his charge increases yearly. Motor vans are also becoming much more numerous, while a regular motor 'bus traffic has been established along various routes. This form of traffic is more destructive to the roads than any other at the present time, and is the sole cause of the corrugations which are now formed on ordinary macadam roads. This damage is chiefly caused by the extreme overhang of the body of the car on the back axle, which, combined with the excessive weight and speed, gives a bounding motion to the vehicle, and produces a kind of corduroy surface on the road. The presence of military camps in the district since August last has also greatly added to the traffic on the surrounding roads.

The Classification of Roads.*

By G. MONTAGU HARRIS, M.A., Barrister-at-Law, Secretary to the County Councils Association.

The peculiar British genius for "muddling along somehow" is, perhaps, nowhere better exemplified than in connection with our highway administration. Never have we had in this country—at any rate, since Roman times—a road system deliberately devised for the benefit of the community as a whole, and, in consequence, never have we had any scheme of road classification. The only distinctive terms we have for roads—"main" and "district"—are quite arbitrary and meaningless, since the distinction depends entirely upon the idiosyncrasies of each county council, and consequently is no true classification at all.

Of late years, however, there has been a strong movement in favour of some system of classification. This movement, from whatever quarter it has come, is of a purely practical nature. It may be said to have three objects—convenience of communication, convenience of administration, and convenience of finance.

It will, no doubt, be convenient to consider in the first place what the present position actually is, and how far any principles have been generally accepted.

Mr. Hampton Copnall's report to the Third International Road Congress contained extracts from the reports of the Royal Commission on Local Taxation, 1901, the Departmental Committee on Highways, 1903, and the Joint Select Committee on Financial Adjustments, 1911, in favour of power being given to some central authority to decide which should be the main roads of the country.

At the Road Conference organised by the County Councils Association in 1909, at which practically every association of local authorities, surveyors, and motorists in the country was represented, the following resolutions were passed:—

(1) That the classification of roads should be undertaken by one of the Government departments in consultation with the local authorities, and that all the principal roads should be classified under two heads—viz., primary and secondary.

(2) That the cost of the maintenance of primary roads should be more largely met by increased grants from the Government, subject to such roads being maintained to their satisfaction.

Within a few months of the meeting of this conference, the Road Board was established through the passing of the Development and Road Improvement Funds Act, and, although the new board was not constituted by the Act a central road department, it is more than probable that, in the event of fresh powers or functions with regard to roads being given to any central authority, the Road Board would be the body chosen.

The next important step in the matter was taken by the Departmental Committee on Local Taxation. This committee, of course, dealt primarily with the financial point of view, but as they were clearly of opinion that a different system of Exchequer grants for the maintenance of roads was necessary, and that the existing classification of roads could not form an equitable basis for distribution, they made definite recommendations as to a new method.

The Departmental Committee stated that they strongly supported the view that the power of determining main roads in the future should be entrusted to a central authority, and, further, that that authority should be the Road Board, and they considered that, to meet changing conditions, the classification should be periodically revised.

The following paragraphs of the Final Report of the committee are important for purposes of reference:—

155. Sir George Gibb, chairman of the Road Board, suggested that the roads in administrative counties should be divided into four classes, and that Exchequer grants should be given towards the first two classes, a higher proportionate grant being given for the first class, which would comprise the most important roads of the country, than for the second. He was of opinion that the greater number of classes would facilitate classification and make it possible to give assistance towards the maintenance of a greater mileage. His suggestion that there should be two classes of roads subsidised by the State was supported by representatives of local authorities, but they generally contemplated only a threefold classification. Some witnesses proposed that the entire responsibility for the maintenance of "trunk" roads should be assumed by the State.

The evidence given on behalf of London and the county boroughs was generally in favour of the simpler classification into main roads and other roads, grants being given in respect of the former class only.

156. After careful consideration we agree that such a classification would be sufficient in these areas, but in the case of the administrative counties the proposed threefold classification seems to us the most suitable . . .

We recommend, therefore, that roads in administrative counties outside London should be classified by the Road Board into (*a*) main roads, (*b*) county roads, (*c*) district roads, and that Exchequer grants should be given in respect of the first two classes; and that in London and the county boroughs the classification should be into (*a*) main roads, (*b*) streets, grants being given only in respect of main roads.

157. We are of opinion that it is impracticable to lay down any rules for determining main roads which can equitably be applied to all areas. The variations as regards the nature of the traffic and the conditions of maintenance are too great.

As regards the administrative counties—other than London—we recommend that in determining whether a road shall be classed as a main road the Road Board should have regard to one or more of the following considerations:—

(*a*) That it was originally constructed as a turnpike road or is now a main road;

(*b*) That it is a medium of communication between towns or a thoroughfare to a railway station;

(*c*) That a substantial portion of traffic upon it is not of a purely local character.

159. As regards London and the county boroughs, and other boroughs where the Road Board so decide, the mileage of roads to be recognised as main roads for the purposes of the maintenance grant should, we think, be determined by ascertaining the length of the continuation of all the recognised main roads impinging on the boundary of the borough to some central point or points at which, in the opinion of the Road Board, they cease to have the characteristics of main roads. The councils of these towns should have the same privileges and powers as other authorities of being consulted by, or of making representations to, the Road Board with respect to their roads. . . .

162. The class of county roads should include all roads in administrative counties which, though less important than main roads, may yet be regarded as serving more than merely local purposes. . . .

The Departmental Committee further recommended that the necessary Parliamentary authority should be obtained to enable the Road Board to commence the work of classification at once. This recommendation was immediately carried out, and the Road Board, acting in co-operation with and on suggestions by the Local Government Board, issued a circular dated April 30, 1914, to the highway authorities in England and Wales, with the exception of London and the county boroughs, inviting them to assist in preparing a classification of roads to be used as a basis for grants in aid of maintenance expenditure from the National Exchequer.

This, then, is the situation at the present moment. The principle of the classification of roads by the Road Board appears to be settled, and, presumably, the board's basis of classification into first-class, second-class, and other roads is accepted. The board have obtained from the highway authorities a quantity of material, and, in spite of the postponement of the traffic census, it is probable that they are even now in a position to propose a scheme of classification.

The board's scheme, when submitted, will no doubt receive criticism from many quarters. The question is whether some part of such criticism may not be forestalled by attempting an anticipation of some details of the scheme, and by throwing out some suggestions, a discussion of which might give an indication to the board and the Government as to the lines which would be most generally acceptable.

It is certainly satisfactory that the board, differing in this from the Departmental Committee, have

* From a paper read at the recently held National Road [illegible]

adopted the term "main roads," and that we can therefore in our consideration use it in its present official sense without any fear of confusion with the "first-class" roads which are to be established in future.

Now, in considering the question of classification pure and simple, it is natural to say that the first-class roads should include all the most important roads in the country. There is a suggestion in some quarters that a certain number of these—which might be known as "trunk roads"—should be placed on a somewhat different footing from the first-class roads. There are certain administrative and financial aspects of this question which will be dealt with later. For the moment it seems enough to say that we might, roughly, put the mileage of the great thoroughfares from London to the extreme points of England and Wales, linking up the great cities, at about 2,500 miles as a minimum, and that therefore we might provisionally consider this to be the mileage of "trunk" roads, if any. For the purposes of this part of the paper, however, these roads will be taken as being included in the first-class roads.

The next question is where to draw the line between the first and second class roads. The Road Board prudently declined to give any definition. The Departmental Committee, as stated above, recommended certain considerations to which the board should have regard in making their classification, and the first question is whether, by basing their classification on these considerations, the board is likely to include in the first class a fair proportion of the total mileage of roads in the country.

For the year ended March 31, 1913, the mileage of roads in England and Wales was as follows:—

Main roads (urban)	...	...	...	4,358
,, ,, (rural)	...	...	...	23,684
Boroughs, other than main roads	...	...	...	4,955
Urban districts	,,	...	...	11,741
Rural ,,	,,	...	...	94,936
County boroughs	...	...	...	10,056
London...	...	...	...	2,210
				151,920

From this it appears that the existing main roads in England and Wales amount to 18 per cent of the total mileage of roads of all kinds. If the roads in London and county boroughs are omitted, the main roads amount to about 20 per cent of the remainder.

As the Departmental Committee point out, in any new classification many of the present district roads would in future be classed as first-class roads, while many of the main roads would become second-class. They stated, however, that on the whole they could "see no reason why the total mileage of main —*i.e.*, first-class—roads in the administrative counties should be appreciably different from the present figure."

This assumption, then, provides for the allocation of about 28,000 miles of road to the first class.

The Road Board has been obtaining a census of traffic on the roads of the country, but, although this is, of course, a most important element, it is certain that it will not be taken as the sole deciding factor in the classification. Generally speaking, the first consideration would appear to be whether or not a road is a means of communication between places of importance. If all roads answering that description are placed in one class, it is clear that that class will include all roads which bear a heavy traffic as well as a large number which do not.

As things are at present there are no county boroughs and very few non-county boroughs or urban districts in England and Wales which have not at least one main road connecting them with the rest of the world, while in the majority of counties the same may be said of every railway station. It may therefore safely be said that the present mileage of main roads represents at least as great a mileage as would be attained by scheduling all roads which form direct means of communication between London and each of the county boroughs or between the county boroughs themselves, together with some road connecting every urban district and every railway station in the kingdom with some one of these roads. In view of the large margin of main road mileage in some counties over and above this definition, it seems clear that the Departmental Committee's proposal that the first-class roads may be estimated to amount to about the same mileage as the existing main roads —about 28,000 miles—will considerably exceed what may be called the irreducible minimum, and may be considered as satisfactory.

(To be concluded.)

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not rather remarkable that, whereas the Local Government Board recently issued a circular to local authorities pointing out that if men could be spared for the fighting line there were others quite willing to take, and capable of taking, their place, only a few days ago, in answer to a question by Sir L. Chiozza Money in the House, Sir John Simon in his reply stated, *inter alia*, that he had found, on inquiry, with regard to certain men who had not joined, that "most of the others are employed in Government or municipal service *from which they cannot be spared*"? Do not the familiar words of a formerly popular music-hall song come into our mind? We don't know where we are.

* * * *

Apropos of this circular from the Local Government Board, have there yet been noted any cases of local authorities who have acted on the suggestion that they might let their officials go to the Front when the latter desired to do so, and that their places might be temporarily filled by older men who were willing and capable of performing their duties? Have there not, on the other hand, been numerous cases of local authorities making it very difficult, indeed making it impossible, for men to do their duty as *men* at this critical time?

* * * *

Should not the report of the Eastbourne Town Council with regard to the financial success of their motor omnibus undertaking during the financial year ending March 31st last give the London County Council food for reflection? Will not the latter body realise that they have been "backing the wrong horse" when it is seen that on such a small capital account of £19,868, including nearly £7,000 for the depot, the Eastbourne Council have made a nett profit for the year of £3,078? Would not many like to know the nett loss on the London County Council tramways undertaking for the same period?

* * * *

Touching the annual dinner of the Institution of Municipal and County Engineers, at which there was a very large attendance, would it not have been better if the 7s. 6d. a head for tickets had been diverted to the Orphan Fund of the institution, or even to the purchase of War Loan Stock at this juncture? When shall we listen to the voices of those who know that if we go on in our usual spendthrift way during the war we shall land ourselves in trouble, and not only "annual dinners," but even "meetings" will be "things of the past"? Is it not to be feared that the German heel will squeeze all that out of us if it once comes down on our beloved soil?

* * * *

Why did the West London Police Court magistrate object to the word "employee" the other day, and prefer the word "servant"? Is it not found in the Imperial Dictionary, and a very useful word at that? Does it not include "servants," whereas "servants" does not include "employees"? Why should he also have objected to the word "civil servant" as "a new kind of snobbishness" when the word is far older than the magistrate himself? On the other hand, do not witnesses often suffer from a very old form of snobbishness—that of being "sat upon" when giving evidence?

* * * *

Although some of the members of the Institution of Municipal and County Engineers appeared to disapprove of any criticism of the annual report of the council, is it not always a healthy sign when an annual report is discussed, and not merely agreed to as a matter of routine? Was there not some truth in the criticism of the altered constitution of the council? And what was meant by the ex-president's cryptic remark at the end of his summary of the discussion to the effect that "the names of six past-presidents had appeared in the report owing to a printer's error, and that it would be duly corrected"? What have these six past heroes been up to?

Coventry Housing and Sewage Undertakings. On the Coventry housing undertaking there is a loss on the year of £103. On the sewage farm a profit is shown of £898 on the agricultural working, and after allowing cost of treating the sewage the nett working cost of the year was £634, against £1,788 in the previous year.

Non-Septic House and Town Sewage Drainage and Sewage-Drainage Ventilation Systems.*

By ISAAC SHONE, Westminster.

It is very gratifying to the author, now that he is practically an octogenarian, to express his belief that the principles and modus operandi, &c., of the Shone compressed air ejector system are more or less well known and practised by the leading sanitary engineers of the world at the present time; but for the reason that the new non-septic sewage drainage and sewage-drainage ventilation systems have only recently been brought to public notice, it follows that the technique of these latter cannot possibly be well known, even to the municipal engineers of England, much less to the public sanitary authorities of England, at the present time.

By way of emphasising the importance of this aspect of the subject, it may be mentioned that it has come to the author's knowledge that some engineering experts, while inspecting the "Karsino" Hotel drainage works a short time since, on looking down upon the 20-gallon "Cuncta-in-Unum," which is fixed in a chamber under the floor of the hotel bar immediately adjoining the Palm Court, came to the conclusion that the apparatus was worked as the original Shone ejector is worked—viz., by compressed air, which, of course, is a fallacy, because the beauty of the "Cuncta-in-Unum" is that it costs nothing to operate, and that it is worked solely by such domestic or other liquid wastes as the householders using it choose to discharge into it, whether these liquids be sewage proper separated from the rainfall, as is the case at the "Karsino," or whether they be sewage proper and rainfall mixed or combined. The "Karsino" Hotel drainage and the Hampton Urban District Council's drainage works, being both under the jurisdiction of the Hampton District Council, are naturally specially interesting to the author, as never before have the two Shone sanitary sewage collecting and ejecting machines—the one called the compressed-air ejector, and the other the hydrodynamic collector-ejector, called the "Cuncta-in-Unum"—worked together in such intimate interdependence as at Tagg's Island, on which the "Karsino" Hotel is built.

When the compressed-air ejector is filled with its charge of liquid, its contents are automatically forced out of it by compressed-air power to any desired point or points of outfall, thereby rendering that apparatus of infinite value to sanitary engineers, who by its aid are able to lay down, both in flat, low-lying, as well as under undulating surfaces, those idealistic gradients which are known to be necessary to enable the drains and sewers to perform their functions efficiently as sanitary sewage carriers. The "Cuncta-in-Unum," however, unlike the compressed-air ejector, cannot be made to lift its sewage charges more than 4 in. above the surface of the liquid within it when it is full, as illustrated by Figs. 3 and 3A. Nor is it necessary, for the sanitary purposes for which the apparatus was designed, that it should lift its fresh non-septic sewage charges the 1/100th part of an inch higher than it does lift them, above the highest as well as the lowest levels to which the sewage rises and falls within it, while it is being actively filled and emptied of its liquid charges, perhaps as often as ten or twenty or more times per day of twenty-four hours. Also, unlike the compressed-air ejector, the "Cuncta-in-Unum" needs no iron or other water valves to operate it, and to interfere with the free flow of sewage. The only valve connected with it is the 1-in. Duralumin reflux air valve, which, as is indicated on the illustration, Fig. 3, is high and dry (about 18 in.) above the top level of the sewage within the apparatus.

The apparatus, as it is illustrated, will be the recipient of a variety of liquid wastes which are characteristic of British home-made sewage, that will be discharged into it *viâ* the soil pipe marked Fig. 1, and the drain marked D_1, and when it is filled to its utmost capacity its contents will be automatically discharged into the public sewer *viâ* the main drain of the house, which is marked D_2.

It will be seen that the water-closet discharges, and the rain falling on the roof of the house, and the bath, lavatory and sink waste waters are to be discharged direct into one soil pipe, marked Fig 1, and that the trapped water of the water-closet has the air of the room in contact with it on the inflow side, and the air of the heavens in contact with it on the outflow or soil-pipe side, and the same ventilation arrangements are provided for the water traps of the bath, lavatory and the sink stone. By utilising the soil pipes in the manner indicated numerous costly and ugly-looking septic rain-water and sink-stone and bath-water gully traps, which are absolutely nothing more nor less than miniature mudlike cesspits or cesspools, will be entirely dispensed with.

Moreover, on the soil pipe, as indicated by the two views of it marked respectively Figs. 1 and 1A, special short pieces, called anti-syphonic pipes, are provided at intervals where required, which act as perfect soil-pipe ventilators, and cheap and efficient fresh air anti-syphonic pipes at the same time.

The roof rainfall waters, of course, need no trap, and none is provided.

As the various waters fall down the soil pipe, and pass the ventilating and anti-syphonic openings on it, the falling liquids will obviously force air out of them, and at the same time pull fresh air after them alternately, and the major portion of such air, when the "Cuncta-in-Unum" is not full of water, will pass through and out of it *viâ* the 1-in. ventilating air pipe at the top of the apparatus till it reaches and passes through the 1-in. Duralumin reflux valve and the 1-in. ventilating air pipe on the sewer side thereof, to ventilate, firstly, the drain marked D_2, and, secondly, the public sewer.

The author will now endeavour to explain the working action of the "Cuncta-in-Unum" apparatus. To enable him to do so all the more clearly he begs to be allowed to refer to a most interesting and instructive paper on "Flushing Tanks," which was prepared for and read to the Civil and Mechanical Engineers' Society on October 1, 1903, by Mr. C. T. Alfred Hanssen, Assoc.M.Inst.C.E., who was then the president of that society, in which were given illustrated descriptions of such flush tanks as, in the opinion of its author, were worth mentioning in his presidential address. In that paper references were made "to very complete series of experiments on the effect of flushing sewers" by Mr. S. H. Adams, Assoc.M. Inst.C.E., and from which he (Mr. Hanssen) deduced tentative formulæ based upon Mr. Adams' experiments for the consideration of sanitary engineers. The author may add that Mr. Hanssen's original empirical formulæ, after much friendly discussion, in which his late partner, Mr. Edwin Ault (deceased), and Mr. Bosker, Assoc.M.Inst.C.E. (who was at that time one of Shone & Ault's assistants), took part, were somewhat modified. Unfortunately, the author has not been able to verify the approximate correctness of even the amended formulæ as he had desired and hoped to do ere this, from practical experiments in connection especially with the "Cuncta-in-Unum" apparatus. But in the absence of actual practical tests the following formulæ and calculations may be accepted as being all-sufficient for the present to estimate the potentialities of the "Cuncta-in-Unum."

The theoretical mean velocity with which the liquids will be discharged out of the "Cuncta-in-Unum" apparatus, whether to flush and ventilate the main drains of houses or the public sewers of towns, &c., can be readily calculated from the well-known fundamental formulæ, which is as follows:—

$$v = 8{\cdot}025\sqrt{h}$$

where

v = velocity of discharge in feet per second

h = height from the centre of the discharge pipe to the centre of gravity of the water contained in an apparatus of 10 gallons capacity, of which Plate 3 is a skeleton drawing.

But the actual velocity of discharge is, of course, much less than the theoretical velocity owing to the small bore of and the sharp bends in the syphonic pipes, and to the high velocity at which the sewage waters are made to flow through them out of the "Cuncta-in-Unum."

The area of the syphon pipe, as taken from a full-

* Paper presented at the recent annual meeting of the Association of Municipal and County Engineers.

size drawing by means of a planimeter, is 11·17 sq. in. = 3¾ in. diameter. The area of the bends at the top and bottom of the syphon is slightly less than this viz., 10·7568 sq. in. = 3⅜ in. diameter.

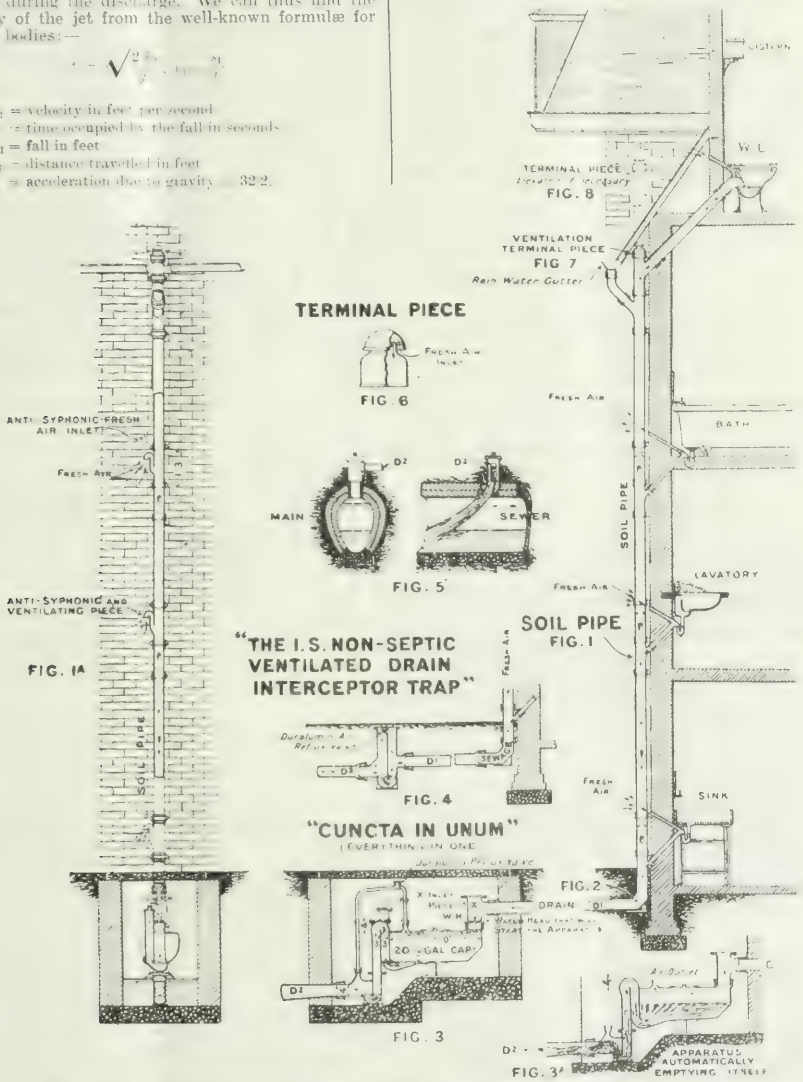
In order to ascertain the actual velocity of the discharge, measurements have been taken of the two dimensions s_1 and h_1, the distance the jet is projected and the height through which the water falls into a tank during the discharge. We can thus find the velocity of the jet from the well-known formulæ for falling bodies:—

$$t = \sqrt{\frac{2 \times h_1}{g}} \quad \text{and} \quad v_1 = \frac{s_1}{t}$$

where

v_1 = velocity in feet per second
t = time occupied by the fall in seconds
h_1 = fall in feet
s_1 = distance travelled in feet
g = acceleration due to gravity = 32·2.

just about twenty seconds. During this period there is a considerable variation in the volume of the discharge per second, but the velocity of the discharge is nearly constant during the whole of the twenty seconds, as shown by the form of the trajectory. Neither is there any appreciable difference in the trajectory of a 20-gallon and a 10-gallon "Cuncta-in-



THE SHONE NON-SEPTIC SEWAGE DRAINAGE AND DRAINAGE VENTILATION SYSTEMS

Taking the mean from a number of observations, it was found that—

$s_1 = 1{\cdot}225$ ft.
$h_1 = 1{\cdot}5465$ ft.

$$t = \sqrt{\frac{2 \times 1{\cdot}5465}{32{\cdot}2}} = 0{\cdot}3101 \text{ second}$$

$$v_1 = \frac{1{\cdot}225}{0{\cdot}3101} = 3{\cdot}95 \text{ ft. per second} = \frac{s_1}{t}$$

The actual velocity of discharge from the 20-gallon tank, where $h = 1{\cdot}474$ ft., is therefore very nearly

$$v_1 = 8{\cdot}025 \times 0{\cdot}495 \times \sqrt{1{\cdot}474} = 3{\cdot}95 \text{ ft. per second},$$

or about 40·5 per cent of the theoretical velocity which should result from a syphon pipe of this size and shape.

The actual discharge from a 20-gallon tank last-

Cuncta," as both have the same size of inlet, outlet pipe and the same fall.

FLUSHING EFFECT OF THE "CUNCTA-IN-UNUM."

The distance to which an effective flush extends may be found, approximately, from the formula

$$l = 0{\cdot}231 \sqrt{\frac{Q\,(v_1^2 - v_2^2)}{a\,(s_m - s_1)}}$$

where

l = length of sewer flushed in lineal yards
Q = quantity of flushing water in cubic feet
v_1 = initial velocity, feet per second = 3·95 ft.
v_2 = final velocity required for an effective flush, say 2·75 ft. per second
s_m = theoretical gradient corresponding to the mean velocity

$$\frac{v_1 + v_2}{2} = \frac{3{\cdot}95 + 2{\cdot}75}{2} = 3{\cdot}35$$

The gradient is found from the Shone hydraulic tables, given in the author's book, "Sewage Drainage Systems," Part I., by dividing the mean velocity as found above by the velocity which obtains in a 6-in. drain laid at a gradient of 1 in 10,000, as given in column 16 of Table III., on p. 363.

The sewage in a 6-in. drain laid at a gradient of 1 in 10,000 will have a velocity of 0·3087 ft. per second, and as the velocity varies as the square root of the gradient, we find that $100\sqrt{\frac{3{\cdot}35}{0{\cdot}3087}} = 100\times$ the sine of the inclination required to give a velocity of 3·35 ft. per second = 10·5.

By referring to Table V., p. 376, of the above-mentioned volume, which gives the gradients corresponding to $100\sqrt{s}$, we find 10·85 corresponds to a gradient of 1 in 85, or 0·011765.

s_1 = the actual gradient of the 6-in. sewer to be flushed, say 1 in 240 = 0·004167.

s_2 = cubic inches in square feet of the stream of flushing water in drain pipe. This is equal to the full diameter of the 1-in. outlet pipe from the "Cuncta-in-Unum" = 0·0873.

For a 20-gallon tank, $Q = 320$ cubic in., and therefore

$$l = 0{\cdot}291\sqrt{\frac{3\cdot(6{\cdot}95^2 - 2{\cdot}75^2)}{0{\cdot}0873\ (0{\cdot}011765 - 0{\cdot}004167)}}$$

$$l = 0{\cdot}291\sqrt{\frac{25{\cdot}728}{0{\cdot}006633}} = \text{V}57{\cdot}3 \text{ lineal yards},$$
$$/172 \text{ lineal feet}.$$

The length of sewer flushed by a 10-gallon "Cuncta-in-Unum" under the same circumstances would be

$$l = 0{\cdot}291\sqrt{\frac{100\ (6{\cdot}95^2 - 2{\cdot}75^2)}{0{\cdot}0873\ (0{\cdot}011765 - 0{\cdot}004167)}}$$

$$l = 0{\cdot}291\sqrt{\frac{12{\cdot}864}{0{\cdot}006633}} = \text{V}40{\cdot}52 \text{ lineal yards},$$
$$/121{\cdot}56 \text{ lineal feet}.$$

It will be seen from the above formulæ that the effect of the tank as a flusher increases as the square root of the volume of sewage it contains. A 20-gallon tank will therefore, when other conditions remain the same, flush to a length of $\sqrt{\frac{20}{10}} = 1{\cdot}414$ times further than a 10-gallon tank. A 40-gallon tank will flush twice as far as a 10-gallon tank, and so on. Similarly, if the discharging capacity of the apparatus were increased from 10 to 250 gallons the flush would then reach to, and be effective for, a length of $121{\cdot}56\times$

$$\sqrt{\frac{250}{10}} = 121{\cdot}56\times5 = 607{\cdot}8 \text{ ft}.$$

The effect further increases in a somewhat greater ratio than the initial velocity of the discharge, and it is therefore important that this initial velocity should be as high as possible. It should, however, be observed that for very high initial velocities the mean velocity v_m is no longer the arithmetical mean between the initial and final velocity, but that it varies as a hyperbolic curve, and that it becomes

$$v_m = v_2\left(1 - \log\frac{v_1}{v_2}\right) - \frac{v_2}{v_1}$$

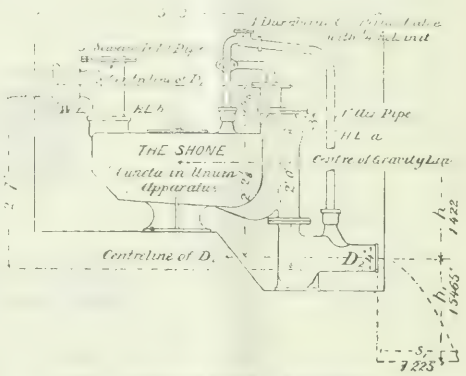
The effect of the flush is further increased with the gradient of the sewer to be flushed. If, for instance, in the above examples $s_m = s_2 = 1$ in 85, the expression $s_m - s_2$ becomes = 0, and l becomes infinite—that is, a volume of water which will fill a 6-in. drain pipe half full of sewage, if discharged into it with an initial velocity of 3·95 ft. per second, will continue to flow with this velocity, if the pipe is laid at a gradient of 1 in 85, because it is the gradient that corresponds to and is required to produce the velocity stated. If the gradient of the pipe is flatter than 1 in 85, the velocity of flow will be retarded, and finally be reduced to that velocity which corresponds to the flatter gradient; or, on the other hand, if the gradient is steeper than 1 in 85, the velocity of the flow in the pipe will increase accordingly.

The author must not omit to refer here also to the Figs. 4, 5, 6 and 7. Fig. 4 shows how the loco-bend or the duck's-foot pipe piece at the bottom of the soil pipe would be coupled up to the short length of drain marked D_1, which lies between the bottom of the soil pipe and the I.S. ventilated interceptor trap, or the "Cuncta-in-Unum" apparatus, as the case may be.

He claims that the I.S. ventilated interceptor trap, shown by Fig. 4, is the smallest, best designed and constructed self-cleansing and self-ventilating interceptor trap ever brought so far prominently to the notice of the British public. It is also the most perfect natural automatic distributor and diffuser in the world of small volumes of drain and sewer air, smellessly and imperceptibly, into the atmosphere at innumerable points, whether these be close to or widely apart from each other, and that without causing any offensive, insanitary nuisances to the citizens, or the sanitary authorities, or the Governments paying for the works necessary to solve practically perfectly and for all time the important sanitary engineering problems and reforms outlined above.

The two illustrations above Fig. 5 show how, by connecting future house drains to the tops instead of to the sides of public sewers, whether these latter be of the oval, egg-shaped, or circular form, as was the invariable British custom in the last, as it is also in the present, century, the storage and discharging capacity of future public sewers can be made to hold and carry more than double the volume of sewage and rain waters that they can hold and carry according to the way in which they are designed and constructed at the present time. Moreover, by thus more than doubling the carrying power of public sewers their initial and annual working costs will not only not be increased one penny piece, but actually diminished, while their hygienic functions, on the other hand, will be enormously augmented.

Under these circumstances the municipal engineers of England, who were once most appropriately designated by the late President of the Local Government Board—viz., the Right Hon. John Burns, M.P.—"the



The "Cuncta-in-Unum" Apparatus.

guardians of the public," will assuredly strenuously co-operate with the author to try to substitute more scientific, common-sense methods than many of those that are now in vogue for draining houses and towns of their sewage discharges.

Fig. 6 is a drawing of the terminal ventilating pipe piece, which is shown by Figs. 7 and 8.

It will be obvious from what the author has already said that, in his opinion, both the I.S. interceptor trap (Fig. 4) and the "Cuncta-in-Unum" apparatus marked Figs. 3 and 3A, are great improvements upon the present-day English unventilated interceptor traps, which, he believes, were largely responsible in the past as they are in the present century for the creation of inordinate volumes of the foul sewage-gassed air that has always, from its inception down to the present time, insanitated the "English water-carriage plan of sewage removal." Luckily, however, the climatic conditions obtaining in England are not nearly so favourable for the generation of sewage gas within drain and sewers as they are in hot countries—such as India, for example.

While explaining, one day, to a learned friend of mine the far-reaching insanitary effects produced by the English unventilated non-self-cleansing interceptor trap, and the far-reaching hygienic effects produced by the ventilated self-cleansing "Cuncta-in-Unum" interceptor trap, he remarked: "Cessante causa, cessat et effectus," which, translated into English, means, "When the cause comes to an end, (then) the effect comes to an end," or, "When the cause disappears, the effect disappears also." That the substitution of the "Cuncta-in-Unum" for the present-day English interceptor trap will really result in accomplishing what is so clearly stated in the above quotation, no competent drainage and drainage ventilation engineering expert will doubt for a moment after he has taken the trouble to under-

The Surveyor

And Municipal and County Engineer.

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[illegible] practical working actions as partly portrayed by the figs. 3 and 3A, and by the fully detailed explanations and diagrammatic illustrations that are given in a booklet the author has just written on the subject, and which is now about to be published.

Following the presentation of the foregoing paper at the recent annual meeting of the Institution of Municipal and County Engineers,

Mr. A. E. COLLINS (Norwich) said he had listened to what Mr. Shone had said with great interest. He had also examined and gone through the drawings which he had sent to him. He had been so much impressed with what Mr. Shone had said that he wanted to put in an installation. If the war had not broken out he should have had one in by now. If this system of house drainage worked approximately as well as the ejector it would be a very good system. They had had ejectors working in Norwich for seventeen years, and except during the past few weeks, when they had one broken pipe, they had had no trouble. He believed Norwich possessed the largest installation in the country.

Mr. P. DODD (Wandsworth) said Mr. Shone called his attention to this new apparatus in November, 1912. He took a great deal of interest in it, so much so that, after seeing a practical demonstration of the first apparatus made, he had it fixed on his own house drains for the purpose of testing its efficiency. One of his neighbours also had one fixed on his house drains about the same time, and he was bound to say that they had both worked admirably without the slightest hitch and satisfactorily in every way for upwards of 2½ years. In June, 1913, the new system was installed at the Karsino Hotel, Tagg's Island, and a meeting of the members of the Metropolitan District of the institution was held there in November of the same year, when a demonstration was given, and the system was thoroughly explained by Mr. Shone and also by Mr. S. H. Chambers, the surveyor to the Hampton District Council. The efficiency and success of the system were then proved, and had, he believed, continued with the utmost regularity up to the present time. Now, it seemed to him that this new antiseptic drainage system solved that most difficult problem of the intercepting trap. In paragraph 9, p. 3, of the Report of the Departmental Committee appointed by the Local Government Board with regard to the use of intercepting traps in house drains it was stated that the alleged disadvantages of the intercepting trap fall into four groups. One was that it formed an obstacle to the passage of air from the sewer through the house drains. The second was that the trap involved separate ventilation of the house drains. The third was that the intercepting trap complicated and enhanced the cost of construction of house drains. And, lastly, that it formed a serious impediment to the passage of sewage from the house drain to the sewer. The Cuncta-in-Unum apparently disposed of all these objections, inasmuch as it was an automatic self-cleansing intercepting trap, a drain and sewer flusher and ventilator combined. It ventilated the house and sewer side of the trap, it did not require separate ventilation for the house drain, it diminished rather than increased the cost of construction of house drains, because the gradients need not be so steep, rain-water pipes could be utilised for soil pipes, or *vice versâ*, rain-water and waste-pipe gullies were dispensed with, the long lengths of costly anti-syphon pipes were not required, and the soil and ventilating pipes need not be carried higher than the highest water-closets; moreover, the apparatus could be adapted to a combined or separate system of drainage. It appeared to him that Mr. Shone had made a very strong case for investigation by this institution, with a view to representations being made to the proper authorities for an early revision or extension of the existing by-laws relating to house drainage, so as to admit of the new antiseptic system being adopted by local authorities. He had much pleasure in proposing that a hearty vote of thanks be accorded to Mr. Shone for his valuable paper.

SEWAGE DISPOSAL IN THE RIBBLE WATERSHED.

CHIEF INSPECTOR'S ANNUAL REPORT.

In his report for the year ended March 31st last Mr. Edward Halliwell, chief inspector to the Ribble Joint Committee, states that during the first half of that period there was a continued steady progress with extensions and alterations to sewage works within the area of the committee, and several important schemes had been forwarded to and considered by the Local Government Board with the view to a loan for carrying out the work.

Following the outbreak of the war, the Local Government Board expedited the holding of the inquiries, as it was considered that schemes for new sewers and alterations to sewage works were of a nature likely to provide suitable employment in cases of distress due to dislocation of trade; but latterly schemes have been suspended partly to conserve the financial resources, and partly owing to the shortage of labour and the urgency of available labour being utilised in a different direction.

During the year the treatment at the sewage works has, on the whole, been as well carried out as the plant permitted, and in this connection Mr. Halliwell thinks it is advisable to bear in mind that sewage works, unless kept in good working order, will rapidly deteriorate in efficiency, and can only be restored at a cost out of all proportion to any temporary saving.

With regard to pollution by manufacturers' trade liquids, the effect of the war differed according to the class of trade. In some branches of the paper trade there has been an increased output, in some a decreased output, which caused mills to decrease the number of working days per week, but no decrease in the working hours per day, while in others there has been a difficulty in obtaining raw materials. In the calico printing and dyeing trades some factories worked a shorter number of hours per day, and others fewer days per week. The effect on the stream has been noticeable during those days when no manufacturing was in progress. In a few branches of the bleaching trade there has been such an increased output that the purification plant has been overworked, and caused increased pollution.

Coast Sand Dunes, Sand Spits and Sand Wastes. By Gerald O. Case. 5s. nett. London: St. Bride's Press, 24 Bride-lane, E.C.—This work is a treatise on the advantages of the proper utilisation of inblown sand, so as to turn it into a protection against coast erosion, instead of being, as too often at present, an active agent in such erosion and in the laying waste of fertile land. The author draws many of his examples from Scotland. He points out the work that has been done on the Continent in turning sand wastes into pine forests. The book gives an able and systematic treatment of its subject.—*Scotsman.*

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

[illegible] are invited to the following :—

491. Books on Bridge Design.—Please give the name of a thoroughly practical book or books on the design of modern highway bridges. The book or books required must deal with the practical design rather than an abundance of theoretical calculation, and must be up to date. ("Theo.")

492. Hydraulics: Adjoining Locks.—There are two [illegible] side by side. The differential head of water is 9 ft., and the area of larger lock is 200 ft. by 40 ft., and that of the smaller is 120 ft. by 25 ft. The depth of water in cills when the lock is empty is 15 ft. The [illegible] are connected by a sluiceway placed at the [illegible] of the lock, having an opening of 16 sq. ft. Neglecting friction and assuming the water to fall freely, calculate how long it will take to establish equilibrium with the sluice fully open. What allowance would have to be made in practice? (J. G. W., *Downpatrick.*)

493. Theory of Beams.—A girder is continuous over two spans of 20 ft. and 15 ft. respectively. What are the relative reactions of the three supports? (Inquirer.)

494. Strength of Pillar.—A solid, square pillar, 10 ft. in height, with a section 2 ft. by 2 ft., and weighing 50 cwt., is subjected to a horizontal wind pressure of 28 lb. per square foot on one side. Assuming its material to be uniformly elastic, find the intensity of compressive stress at the leeward edge and at the windward edge of its base.

495. Radius of Gyration.—Explain from first principles the precise meaning and significance of the term "radius of gyration" as used in the investigation of the theory of beams.

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

489. Road Making. What is the best material, from [illegible] to make paving setts for use in a carriageway of steep gradients? Give reasons.

The following additional reply to this question [illegible] and other has not reached us:—

As assuming that the roadway is required to carry an appreciable amount of heavy traffic, granite setts would make a good pavement on steep gradients. The success, however, of this type of paving depends upon the careful selection of the material from which the setts are made, and, moreover, to obtain the best results the latter should be worked into dressed blocks, presenting an even surface to the traffic, and should be laid with narrow joints. A paving should be durable, sanitary, silent, easily maintained and repaired, and should provide good foothold for horses, and reduce to a minimum the danger of skidding of mechanically propelled vehicles. As the question refers to steep gradients, the primary condition that the selected material must satisfy is the last mentioned, and granite setts of the best quality have this characteristic in addition to the foregoing. The rock used in the manufacture of paving setts should be hard and tough, in order to wear well and withstand severe blows; it should be non-absorbent, so as to be sanitary and unaffected by frost. The chief constituents of granite are quartz, felspar and mica, the two former of which are highly resistant substances, while the mica is a soft mineral; and it is essential that a correct balance between the hard and soft ingredients should exist in the granite or other material. A suitable granite would contain 20 per cent, or thereabouts, of the soft minerals. If the granite has too fine a grain, and contains too high a percentage of the hard minerals, it tends to become smooth and slippery under wear; whereas, on the other hand, if the stone is too coarse-grained, containing too high a percentage of the soft constituents, the material in all probability will not be sufficiently tough, the arrises of the setts will break or wear unduly, and a noisy, uncleanly pavement will result. The material, therefore, to be employed for paving purposes should contain the correct proportion of the hard and soft minerals mentioned, and must be of a homogeneous texture. A granite of this nature does not lose its grittiness, for the softer grains wear quicker than the harder ones, the latter forming small nodules on the surface of the pavement upon which the foothold and anti-skidding properties of the material depend. Granite setts are often said to produce a noisy pavement, but if the setts are composed of carefully dressed blocks, and are laid with narrow joints on a firm foundation, no serious nuisance should occur. (M. T. R., *Rhyl.*)

490. Hydraulics.—Find the ratio which must exist between the breadth and depth of water flowing in an open channel of rectangular cross-section, in order that the velocity of flow may be at its maximum. (N. W. K., *Bury St. Edmunds.*)

The following formula is frequently used to find the velocity of water flowing in open channels — viz., $V = C\sqrt{mi}$.

Where V = velocity of flow in feet per second

C = constant depending upon the condition of the channel

m = hydraulic mean depth = $\frac{\text{area of channel}}{\text{wetted perimeter}}$

i = inclination of channel.

In this formula C and i are always constant, so if the velocity is to be maximum, m must be maximum.

Let x = depth of channel

and y = breadth of channel

then $m = \frac{xy}{2x + y}$

The product xy is always a constant quantity, though x and y are each variable—

$$i.e.,\ xy = K$$

$$\therefore\ y = \frac{K}{x}$$

Since xy is constant $\frac{xy}{2x+y}$ will be maximum when $(2x + y)$ is minimum.

$$2x + y = 2x + \frac{K}{x}$$ and differentiating

$$2dx - \frac{K\,dx}{x^2} = 0$$

$$2 = \frac{K}{x^2} = \frac{xy}{x^2}$$

$$2x^2 = xy \quad y = 0$$

$$2x = y$$

$$\therefore\ x = \frac{y}{2}$$ or 0. The latter value is absurd.

∴ for maximum velocity the breadth of a rectangular channel should be twice the depth.

(J. G. W., *Downpatrick.*)

Taking the well-known Chezy formula $V = C\sqrt{mi}$.

Where V = velocity

C = constant

m = hydraulic mean depth

i = inclination.

The factors on the right-hand side of the expression which are constant are i and also C, which, though varying in extreme cases, may for all practical purposes be taken as constant also.

This leaves us then with m the variable factor.

$$m = \frac{\text{area of flow}}{\text{wetted perimeter}} = \frac{b \times d}{2d + b}$$

Now for any one case the area of flow is constant; then let $b \times d = a$.

Then $d = \frac{a}{b}$

$$\therefore m = \frac{a}{\frac{2a}{b} + b}$$

Multiplying top and bottom by b, $m = \frac{ab}{2a + b^2}$

Differentiating $\frac{dm}{db} = \frac{a(2a + b^2) - ab \times 2b}{(2a + b^2)^2}$

$$\frac{2a^2 + ab^2 - 2ab^2}{(2a + b^2)^2}$$

$$\frac{2a^2 - ab^2}{(2a \times b^2)^2}$$

Now m is a maximum when $\frac{dm}{db} = 0$

$$\therefore \frac{2a^2 - ab^2}{(2a + b^2)^2} = 0$$

$$\therefore 2a^2 - ab^2 = 0$$

$$\therefore 2a^2 = ab^2$$

$$2a = b$$

but $a = bd$ $2bd = b^2$

$$\therefore d = \frac{1}{2}b.$$

The foregoing shows that, to obtain the greatest velocity, the depth should be equal to half the breadth; for practical reasons, however, it is sometimes necessary to lessen the depth, as, for instance, to lessen the strain upon the sides. It is also interesting to note that this proportion arrived at gives the least wetted perimeter, and therefore necessitates the least quantities of material to construct it.—[W. S. J., *Birkenhead.*]

SEWAGE COMMISSION AND MANUFACTURERS' WASTES.

MR. EDWARD HALLIWELL AND THE NINTH REPORT.

A number of points in the recently issued Ninth Report of the Royal Commission on Sewage Disposal, which, it will be recollected, deals, for the most part, with the discharge of manufacturing waste which for any reason cannot be taken into the sewers, are touched upon by Mr. Edward Halliwell, F.I.C., chief inspector to the Ribble Joint Committee, in his report for the year ended March 31st last.

Mr. Halliwell quotes the view of the commission that the Rivers Pollution Prevention Act, 1876, is, as regards these liquids, unsatisfactory, and ought to be amended, and adds that, briefly, the suggested alterations mean that the new central authority should fix a general standard for each trade, and that the exceeding of a standard is an offence for which a penalty should be imposed. Provision, he further points out, is made for appeal by the manufacturer to the central authority, and the commissioners suggest, for the guidance of the central authority, what limits of impurity should be fixed for each trade.

In fixing the provisional standards they divide the wastes into two classes—namely, (1) "those for which efficient purification is practicable," and (2) "those for which efficient purification is not, in the present state of knowledge, practicable." They sub-divide the first class into two groups—"those cases in which the adequate reduction of solids in suspension may be regarded as efficient purification," and "those cases where the dissolved impurities should also be removed."

"It is interesting," observes Mr. Halliwell, "to find in this latter group that 4 parts per 100,000 of dissolved oxygen absorption in five days is the suggested standard.

"As the commission in a previous report have defined 'pollution,' and have fixed the standard for sewage effluents at 2 parts per 100,000 of dissolved oxygen absorption in five days, it would seem less contradictory if they had stated that 4 parts per 100,000 of dissolved oxygen absorption was the limit of pollution which could be allowed rather than term it 'efficient purification.'

"It is surprising to find that the class, 'those for which efficient purification is practicable,' includes the liquids from breweries, tanneries, wool-scourers, &c., whereas the liquids from bleachers, paper-makers, cotton printers and dyers, &c., are included in that class 'for which efficient purification is not, in the present state of knowledge, practicable.'

"Experience in this watershed points to the former-mentioned liquids as being much stronger and as difficult to purify efficiently as those in the latter group.

"There seems good reason for thinking that some trades have been included in the heading 'for which efficient purification is not, in the present state of knowledge, practicable,' because the commission have either not had the time or the opportunity of making the experiments which they have carried out in those trades in which they have fixed a limit of dissolved impurity.

"In the second group the standard for liquids from cotton dyeing is fixed at 4 parts per 100,000 of suspended solids, and from the calico printers and bleachers the standard is 6 parts. In this watershed one often finds that bleaching is carried on as a preliminary process to cotton dyeing, and that cotton dyeing is largely carried on by calico printers. It would cause less difficulty in administration if the standard was the same in each trade.

"In the suggested alteration of the law provision is also made for the rivers boards to require more stringent standards, with appeal to the central authority. This provision is a very desirable one, as, although in the Ribble watershed many of the bleachers, calico printers and paper-makers discharge effluents which meet the standard of suspended matter, there is still marked pollution of the stream.

"In commenting (see p. 95 of the Ninth Report) upon a table of figures relating to liquids from paper works, which I had presented when giving evidence, the commission state:

> "In the six foregoing crude liquids the suspended solids varied from 35 to 135, the average being 84 parts per 100,000. In the twenty-one tank and filter effluents the variation in suspended solids was from 2·4 to 280, the average figure being 59. The tank treatment had thus, on the whole, effected a very considerable reduction in the suspended matter. Neither crude liquids nor tank effluents developed sulphuretted hydrogen on incubation, although the figures for 'oxygen absorbed' from permanganate showed the presence of considerable oxidisable matter in the effluents as discharged.
>
> "Whereas a more careful reading of the figures shows that, in the six foregoing crude liquids the suspended solids varied from 59 to 290, the average being 166 parts per 100,000; and eight out of the twenty-seven crude liquids and tank effluents developed sulphuretted hydrogen on incubation."

In conclusion, Mr. Halliwell adds that, while it is inopportune at the present time to criticise in detail these many recommendations, it would perhaps be proper to state that, although there are some features, particularly with regard to standards and analytical procedure necessitated by the standards with which he is not in agreement, there are many recommendations which, if embodied in a new Rivers Pollution Act, would result in a marked improvement in the condition of rivers in this watershed. The prevention of pollution by the sludging of mill lodges and the simplification of the legal procedure, particularly with regard to the time taken to obtain a decision, would, he considers, be most valuable.

The Civic Engineer's Who's Who, compiled by the editor of THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER, for a second annual issue is remarkably complete. The biographical matter is full and methodically arranged. The book is published by the St. Bride's Press, Limited.—*Liverpool Courier.*

The Road Board and Holland County Council.—At a meeting of the Roads and Bridges Committee of the Holland County Council on Tuesday, a letter was read from the Road Board in reply to the council's application for the usual grant in aid of the upkeep of the main roads. The board stated that on the basis of the proposed expenditure on the council's main roads they saw no reason for acceding to the application for a grant. The board required that councils applying for grants should satisfy them that they were making adequate provision for the repair and maintenance of the roads. The chairman, Alderman Whitsed, said the grant was refused because the council would not spend £24,000 on the roads, as they usually did, but on account of the war proposed to spend only £15,000. Mr. Hutson remarked that under the present circumstances he considered that the council were doing the proper thing in not spending so much money on the roads.

Law Notes.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Editor," at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK INK only, and in such style as to be fit for direct reproduction—*i.e.*, without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

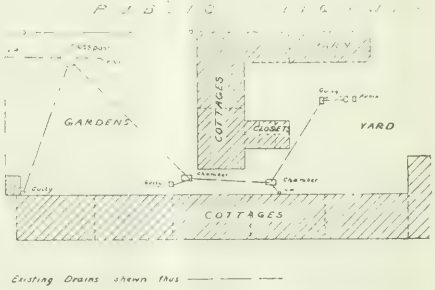
QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. The letter X, combinations such as A.Y.Z., and words such as "engineer" and "surveyor," should never be used.

PERMANENT NUISANCE.—"Perplexed" writes: I shall be much obliged if you will kindly advise me upon the following, which will be greatly appreciated. A plot of vacant land was let on a yearly lease to a showman, A, with roundabouts, swings, &c., which he used as a fair-ground, there being several van dwellings occupied by about twenty persons on the site. Arrangements were made with the water company for a sufficient supply of water by means of a temporary connection between a standpipe at the adjoining cottages and a tank placed on the site. I was informed that they had also made arrangements with the surrounding cottages and the proprietor of an eating-house with whom they were customers for the use of their water-closets, so there was no evidence of a nuisance on the site. A notice under sec. 36 of the Public Health Act, 1875, was served on A to provide a separate water-closet for each sex, constructed in accordance with the council's by-laws, but before the time expired for taking further action he moved away. Since then A has sub-let the ground at intervals to various other showmen for a week or so for the same purpose. A fresh notice, as above, was served on A and one of the showmen occupying the ground, when they again moved away. Now some of the cottagers object to these van-dwellers using their water-closets. (1) Does the word "house" in sec. 36 of the Public Health Act, 1875, include van, tents, &c.? (2) Under this section if the notice is not complied with the local authority may themselves do the work and recover the costs; but as these van-dwellers are constantly moving from place to place, could the costs be recovered from A or the owner of the land? (3) Could this land, when occupied as a fair-ground by steam engines, roundabouts, &c., be held to be a work-place, and a notice served under sec. 9 of the Factory and Workshop Act, 1901, to provide water-closets? I believe a cab-yard, also a cab-rank, have been held to be work-places for the purpose of this section. (4) Do the words "every building," sec. 22 of the Public Health Amendment Act, 1890, include vans, &c., and would it be better to take proceedings under this section? (5) Does sec. 9 of the Housing, Working Classes Act, 1885, have any bearing on this question? (6) Would action taken under sec. 94 of the Public Health Act, 1875, meet the case, seeing that the owner of the land is not the owner of the van dwellings?

(1) We think not, although this would appear to be a question of fact [illegible] *Bailey* v. *Burge*, 1905, 71 J.P., 351). In the absence of any exclusive definition in the statute, the word "house" must be construed in its ordinary popular meaning. Moreover, it was held in *Newell* v. *Ormskirk Urban District Council*, 1907, 71 J.P., 119, that a portable theatre, constructed of wood, and erected for a short period only, where the intention of the proprietor was to move to another locality within a short time, was a "building" within the meaning of by-laws made under sec. 157 of the Public Health Act, 1875. (2) In view of our answer to (1), the [illegible] expenses under sec. 36 are recoverable from "the owner"—*i.e.*, the owner of the "house" upon whom the notice is served. (3) Sec. 9 of the Factory and Workshop Act, 1901, only applies to factories and *workshops* (not *workplaces*). The term "workshop" is defined in sec. 149, and clearly does not include land occupied as in the present case. The case referred to (*Bennett* v. *Harding*, 1900, 2 Q.B., 39) turned upon the meaning [illegible] of the Public Health (London) Act, 1891. (4) From the answers to (1) and (3) it will be seen that sec. 22 of the Public Health Acts Amendment Act, 1890, does not apply to this case. (5) Yes. If a nuisance arises it can be dealt with as if it were a nuisance within sec. 91 of the Public Health Act, 1875. (6) The notice must be served on the person by whose act, default, or sufferance the nuisance arises"—*i.e.*, the van-dweller. If, however, "he cannot be found" (as if leaves the district with a nuisance on the land), the owner of the land must be served as the owner of the "premises" (see definition in sec. 4) on which the nuisance arises. (7) Apart from summary proceedings for the abatement of a nuisance, an action (in which the Attorney-General must join) might be brought for an injunction to restrain the van-dwellers from occupying the land in the absence of proper sanitary arrangements. (See *Attorney-General* v. *Brown*, *Times*, July 23, 1898; *Attorney-General* v. *Stone*, 1895, 60 J.P., 168.)

SEWER OR DRAIN. "Velox" writes: (1) Will you kindly inform me as to whether, in your opinion, any of the drains shown on the accompanying plan constitutes a public sewer? If any part of the system does constitute a sewer, will you kindly state which? (2) In regard to the cesspool, who is responsible for



the emptying of this? The cottages are owned by one owner, and the tenants throw the slop-water down the gullies shown on the plan. Sec. 19 of the Public Health Act Amendment Act is not in force in the parish.

(1) Assuming that the drainage system is that of the yard only, and not of the cottages, we have arrived at the opinion, not without some difficulty, however, that all these pipes are "sewers." Looking at the definition of "drain" in sec. 4 of the Public Health Act, 1875, they are clearly not "used for the drainage of one building only." Are they used for the drainage of "premises within the same curtilage"? We think not (see *St. Martin's-in-the-Fields Vestry* v. *Bird*, 1895, 1 Q.B., 428; *Harris* v. *Sunfield*, 1904, 68 J.P., 516). In the latter case, Justice Phillimore said: "I am clearly of opinion . . . that the word curtilage cannot be applied to anything which is common to more than one messuage, and that two separate houses occupied by two different sets of people, so as to be separate and independent dwellings, cannot be premises within the same curtilage." (2) The cesspool is not part of the sewer (*Meader* v. *West Cowes Local Board*, 1892, 3 Ch., 18); and if any nuisance exists at the cesspool the liability to abate it is on the owner of the yard and garden (*Butt* v. *Snow*, 1903, 89 L.T., 302).

PRIVATE STREET WORKS APPORTIONMENT.—"T. A. J." writes: Will you please inform me how I should apportion the cost of a sett crossing over a footpath in a street, the street being made up under the Public Health Act, sec. 150. (1) Should the cost of the crossing be apportioned over the whole of the frontage owners, or on the one frontage owner, or should the cost of the ordinary flagging of the footpath be taken through the sett crossing, and extra only (setts over flags) be charged to the frontage owner where the crossing is required? (2) Would the solution be the same if the street had been made up under the 1892 Act?

(1) See the answer to the questions submitted by "Ipse Jure" in our issue of May 28th last, at page 674. The case of *Wakefield Urban Sanitary Authority* v. *Mander* (1880), 5 C.P.D., 248, there cited, is some authority for saying that the whole of the cost of the crossing should be apportioned on the one frontage owner, as sec. 150 distinguishes between "paving" and "flagging." We have found no direct authority on the point raised, however, which must be regarded as a doubtful one. (2) Under the Private Street Works Act, 1892, the cost of the crossing should be apportioned over the whole of the frontage owners. (See *The Clacton Local Board* v. *Young & Sons*, 1895, 1 Q.B., 395.)

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Barnsley T.C. (July 14th. Mr. H. Shelford Bidwell). £15,073 for the purposes of the electricity undertaking.—It was explained that the scheme was originally postponed owing to the outbreak of war, but the increased demand last winter rendered the application imperative. The strain was such that the power was on the verge of collapse. The corporation had now a large number of applications for supplies of power, which could not be delayed. The corporation were now only able to give one-quarter of the power required by the munitions factory which was being established in the town. The Local Government Board had authorised preparations to supply the munitions factory. The original proposal had been reduced to the absolute minimum.

Beverley R.D.C. (July 10th. Mr. A. G. Drury).—£12,000 for sewerage works for the townships of Brantingham and Elloughton.—It was mentioned that, though the scheme should be approved, the work would not be carried out until the conclusion of the war. Mr. F. Graham Fairbank, the engineer, of Messrs. Fairbank & Son, York, stated that the proposed outfall would discharge into the river Humber on the ebb tides, and to cope with the sewage at those times when it could not be discharged he proposed to provide an underground storage tank with a holding capacity of 40,000 gallons. The mouth of the outfall would be below water all the time, and there would be an automatic valve which would not come into action until one hour after the tide had started to ebb, and it would cease its action one hour before top water; so that there would be discharging going on for four and a-half hours. On behalf of Brantingham, it was represented that it should be made a special drainage district, but the inspector said he did not think it probable the Local Government Board would consent to this for such a small parish.

Bridlington T.C. (July 13th. Mr. H. Shelford Bidwell).—This was an inquiry into the application for approval of the appropriation of a site for a refuse destructor on land on the west side of the electricity works. Mr. W. H. Shawcross, barrister, for the council, referred to the difficulties the council had experienced for many years in disposing of the refuse of the town. If the proposed site was utilised, it was estimated that there would be a total saving of £846 per annum, after deducting £466 per annum in repayment of capital and interest on the cost of the destructor, which was put at £6,332. Evidence in favour of the site was given by Mr. Greenwell, sanitary inspector; Mr. A. Eccles-ham, acting borough engineer; Captain Arthur John Beckett, borough electrical engineer; Dr. A. K. Jarratt, medical officer of health; Mr. George Watson, of the New Destructor Company; Mr. F. O. Kirby, borough engineer, Doncaster; and Mr. S. S. Parker, surveyor and waterworks engineer, Gainsborough.

Dublin T.C. (July 7th. Mr. P. C. Cowan).—This was an inquiry into petitions presented by the corporation for Provisional Orders confirming improvement schemes in the city. The areas concerned were (1) Crabbe-lane, (2) Boyne-street, (3) widening and improving Lower Liffey-street, and the amounts of the loans required were (1) £39,350, (2) £22,075, and (3) £6,000.—Alderman Thomas Kelly, chairman of the Housing Committee, dealing with the Crabbe-lane area, said the people there were housed in old, dilapidated, insanitary dwellings. Most of the houses were built in the early part of the eighteenth century. It was proposed under the scheme to erect dwellings for 162 families. That would accommodate all the families there at present. If a cottage plan were adopted it would not accommodate half the number of people requiring dwellings; therefore he was in support of three-storey blocks to be let at rents varying from 3s. to 4s. The inspector said that on the figures there would be a loss of £2,027 on the scheme; that would mean a loss of about £12 per dwelling per annum, or 5s. a week on each house. The average rent would be 3s. 6d., but the actual rent should be nearly 8s. 6d. to make it a self-supporting scheme. Alderman Kelly: Of course, that is impossible; we know this scheme could not be self-supporting. Mr. Cowan said that, putting three or four storeys on top of one another was not housing at all; it was overcrowding the people. And on that aspect of the case he would press for reconsideration by the Housing Committee. The only thing in favour of building three-storey houses there was that these people are used to a certain way of living, and to the expression which had not been explained to him. He thought the corporation were taking a very backward step in building so many three-storey houses. The idea should be to give the working classes homes, not boxes in blocks, especially when the cost had to be defrayed out of the ratepayers' pockets. Mr. Thomas J. Franks, solicitor (Messrs. Franks & Oulton), gave evidence in reference to the property in Ormond-quay and Lower Liffey-street. The inspector said he would report favourably to the Local Government Board in regard to a portion, at least, of the scheme. Subsequently Mr. Cowan opened an inquiry in reference to an application by the corporation for a loan of £36,020 for the erection of houses on the M'Caffrey estate, adjoining the North Dublin Union, and £12,940 for houses for the working classes at St. James's-walk, Rialto.

APPLICATIONS FOR LOANS.

Bournemouth T.C.—£400 for the construction of roads and paths at the cemetery.

Bristol T.C.—£850 for works of drainage.

Derbyshire C.C.—£6,000 for the extension of Penmore hospital, and £1,600 for a secondary school at Ilkeston.

Erith U.D.C.—£15,300 for new electrical plant.

Luton T.C.—£4,000 for the electricity undertaking.

Northants C.C.—£7,500 for a technical institute.

Sheffield T.C.—£10,500 for electricity plant.

West Riding C.C.—£5,000 for hospital extension, and £500 for a school at Bentley.

Weymouth T.C.—£2,200 for electricity cables and services.

LOANS SANCTIONED.

Brixham U.D.C.—£300 for the purchase of a site for a hospital.

Derby T.C.—£325 for fencing a recreation ground.

Itchen U.D.C.—£720 for road improvement.

Lewisham B.C.—£1,946 for street improvements.

Newport (Mon.) T.C.—£1,493 for the purchase of a site for a destructor, and £6,350 for road widening.

Shoreditch B.C.—£500 for the purchase of electricity meters.

Stepney B.C.—£21,000 for electrical machinery.

FORTHCOMING INQUIRIES.

JULY.	£
20.—**Llangefni.** For the purposes of allotments (Mr. F. H. Tulloch)	169
20. **Wincanton.** For works of water supply (Mr. P. M. Crosthwaite)	3,330
21.—**Bideford.** For works of water supply (Mr. P. M. Crosthwaite)	—
21. **Walsall.** For the purposes of street improvement (Mr. F. H. Tulloch) ...	—
21. **Warrington.** For the provision of a hospital (Dr. W. W. E. Fletcher)	1,500
23.—**Falmouth.** For the purposes of burial grounds and allotments (Mr. P. M. Crosthwaite)	3,230

HAYWARDS LIMITED.

We are asked to state that, with the consent of the Board of Trade, the name of the well-known firm of Hayward Brothers & Eckstein, Limited, engineers and ironfounders, 187 to 201 Union-street, Borough, London, S.E., has been altered to Haywards, Limited.

Mr. George F. Pittar, the managing director, writes: "Our Mr. Wm. Eckstein and his family are English of several generations back, and he has served many years in the public works department of India; but it has been suggested by several of our principal clients that, owing to the present state of public feeling in connection with the war, the retention of his name in the firm may mislead some of our correspondents and cause them to imagine there is some German interest in the business. As a matter of fact, the firm is entirely a British one, founded in 1783, registered as a Joint Stock company in 1896, and it has no connection, directly or indirectly, with any German or Austrian interests. All the business of the company will be conducted as heretofore. Various contracts for Government work are being carried out, but inquiries and orders will be attended to with all care and promptitude."

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Egremont, Louth; refuse collection—Dover; roads and materials—Castle Ward, Essex, Walton-le-Dale, Westminster; sewerage and sewage disposal—Chester-le-Street, Coventry, Fareham, Swindon; water, gas and electricity—Bradford. Particulars of other projected works will be found in our "Local Government Board Inquiries" page.

BUILDINGS.

Bournemouth T.C.—A letter has been received from the Local Government Board stating that the board agreed that the provision of groynes for the protection of the Undercliff Drive was necessary, but, in existing circumstances, think the cost should be defrayed out of revenue. At the same time, as the work must be regarded as more or less experimental, the board suggest that the council should consider whether some cheaper form of construction could not be adopted in view of the possibility that several more groynes might be required. It accordance with the suggestion of the Beach Committee, the borough engineer, Mr. F. W. Lacey, reported that he had carefully considered as to the best means of constructing the proposed experimental groyne across the beach and foreshore adjoining the Undercliff Drive. The groyne would be constructed with old tramway rails driven into the bed of the sea from 6 ft. to 8 ft. as piles. These piles would be about 8 ft. apart, and encased with concrete cast in blocks, having a 6-in. groove on either side in which 8-in. concrete slabs would be placed to the height required, the whole finished at the top with a reinforced-concrete beam. Having regard to the high price and difficulty in obtaining suitable timber for the purpose under existing conditions, he thought the above form of construction would be as cheap, if not cheaper, than any other. The probable cost of constructing the groyne as proposed was estimated to be from £350 to £400 if carried out by the council's own staff, which he recommended in this case, having regard to the large provision for contingencies and loss of time owing to bad weather any contractor would have to allow for in making his tender, which conditions would not apply to anything like the same extent if the corporation did the work as proposed. The council have agreed to carry out the work as proposed.

Crewe T.C.—The plan of the borough surveyor, Mr. C. Eaton-Shore, for a proposed open-air pavilion at the isolation hospital is to be submitted to the county council for approval.

Egremont U.D.C.—The question is under consideration of building a small pox hospital at an estimated cost of £3,500.

Guildford R.D.C.—It has been agreed to pay a fee of twenty guineas to the Canal Syndicate to cover their engineer's charges for the examination of the plans and all legal expenses in connection with the reconstruction of the Pirbright Canal Bridge. With respect to Wisley Bridge, the council decided that the existing abutment should be relied upon as a sufficient protection from the river, that a new abutment should be built behind, but only carried down to the gravel, increasing the length of the bridge about 8 ft., and that a rough protecting slope of concrete in bags should be constructed where the south-west wing was washed away, at an estimated cost of £450.

Louth C.C.—The design of Messrs. O'Callaghan & Webb, architects, South Frederick-street, Dublin, has been accepted for the new county council offices to be erected in Dundalk.

HOUSING AND TOWN PLANNING.

Croydon T.C.—The Local Government Board have sanctioned the preparation of a town planning scheme for the district of Beulah Hill.

Falmouth T.C.—A further instalment of £1,000 is to be borrowed for workmen's dwellings.

Leamington T.C.—The medical officer of health, commenting in his annual report upon the need for a housing scheme, writes: "I am of opinion, generally speaking, that the demand for houses at a rental ranging from 4s. 6d. to 5s. 6d. per week has by no means decreased, and it is to be hoped that the matter will be taken up again in earnest at a more appropriate time. The question as to whether or not a housing scheme of this character can be made to pay is, of course, of considerable importance, and under normal conditions one feels that such a desirable end could be obtained; but even if the work were carried out at some slight loss to the ratepayers, it would seem worth doing. It has been suggested that use should be made of sites from which buildings have been moved by demolition orders. It is necessary to remember, when considering such a suggestion, that in practically all instances where a demolition order has been made the unsuitability of the site for a dwelling-house of any kind has been so manifest as to render any debate on such a question quite unnecessary."

Newcastle-upon-Tyne T.C.—It is proposed to carry out a town planning scheme for the Denton Burn area.

Torrington R.D.C.—In a letter stating that the proposal to borrow £650 for housing at Shebear must be postponed, the Local Government Board add: "With regard to the plans, according to the detailed estimates put forward, the cost of the whole scheme should not be more than £530. Unless the rents could be materially raised there would apparently be a considerable annual deficit, and in view of the importance of economy the board considered that the size of the proposed houses should be reduced. There did not appear any sufficient reason had been given for making the cost of the scheme chargeable on the parish. It was decided to send the Local Government Board's suggestions to the architect, Mr. Medland, and to take no further action in regard to the scheme for the present.

PARKS AND OPEN SPACES.

Oldbury U.D.C.—Mr. W. A. Albright, a member of the firm of Messrs. Albright & Wilson, of the Oldbury Phosphorus Works, has handed to the council the title-deeds relating to upwards of 20 acres of land near Barnfoot Hill, adjacent to Farm-road, Langley, and Moat-road, Warley, and which he has presented to the town to be used as a public park, playing fields and recreation ground. The cost of the fencing and laying out the ground, amounting to about £800, has also been borne by the generous donor.

REFUSE COLLECTION AND DISPOSAL.

Dover T.C.—It has been agreed to affix the corporate seal to the contract and agreement with the Edison Accumulators and the Car Corporation of Great Britain, Limited, respectively, for the supply of six electric scavenging vehicles.

Swansea T.C.—The town clerk has received instructions to take the necessary steps for revising the by-laws with a view to the compulsory provision of back lanes for new property in order to facilitate the removal of refuse.

ROADS AND MATERIALS.

Andover R.D.C.—The surveyor, Mr. J. Wormald, has been requested by the military authorities to prepare an estimate of the cost of constructing a road from Park House camp towards Bulford to the Andover boundary.

Antrim R.D.C.—The council recently had under consideration a special report of the county surveyor with reference to the working of the direct-labour scheme, and after discussion it was decided that the Public Works Committee of the county council should be asked to prepare a scheme for direct labour for the Antrim district.

Bournemouth T.C.—The chairman of the Horse Committee, Councillor Beaton, stated at the Tramways Committee that owing to the shortage of horses it had been suggested that the trams might be used, as they are used in other towns, for the purpose of street watering. The general manager was instructed to obtain information as to prices, and report. It was understood that the watering would be done by means of apparatus attached to the trams.

Broadstairs U.D.C.—Tenders are to be obtained for 50 tons of granite macadam for certain new roads.

Castle Ward R.D.C.—It is proposed to carry out a road improvement scheme at Portaferry, at an estimated cost of £6,000.

Cork T.C.—Congratulatory references were made recently by members of the Public Works Committee to the manner in which the city street improvement scheme has been carried out by the city engineer, Mr. S. J. F. Delaney, and his staff.

Coventry R.D.C.—An order has been received from the Local Government Board investing the council with urban powers with a view to making up a number of streets.

Essex C.C.—In accordance with the requirements of the military authorities, it has been agreed to reconstruct the road from Bishop Stortford to Haverhill, at an estimated cost of £7,000.

Formby U.D.C.—The surveyor, Mr. T. Grime, reported that a sub-committee visited Great Crosby and inspected the tar-sprayer in use there, and as a result they recommended the acceptance of the tender of Messrs. Llewellin & James, Limited, of Bristol, for the sum of £27 10s., for one of these appliances. This the council agreed to.

Halifax T.C.—It has been decided to carry out private street works, at an estimated cost of £249.

Northants C.C.—Subject to the sanction of the Treasury, the Road Board propose to make a grant of £1,27 towards the cost of improving, and £1,87 towards the cost of fencing.

St. Austell R.D.C.—It was stated recently that the matter with respect to the construction of the suggested new road from Trelavour to Whitemoor had been practically settled, and that the council were only waiting for the agreement with Lord Falmouth's agent with respect to the land.

Southport T.C.—It was decided on Wednesday last to purchase a motor water cart.

Swindon T.C.—A widening scheme is to be carried out in Cricklade-road at an estimated cost of £440.

Uckfield R.D.C.—The surveyor, Mr. E. Ray Jones, reports that he has been appointed to superintending work of road improvement at Maresfield field camp, at the request of the military authorities. A report on the subject has been forwarded to the Road Board, and the council decided to send a report to the War Office also.

Walsall T.C.—A scheme for the widening of one of the most important business thoroughfares in Walsall—Lower Bridge-street—will be submitted to a special meeting of the council. It is understood that the proposal is to acquire the property on practically the whole length of one side of the street, and to set it back, thus enabling the thoroughfare, which is at present very narrow, to be widened to 60 ft.

Walton-le-Dale U.D.C.—The council resolved recently to ask the county surveyor to proceed with the reconstruction of the highway from St. Saviour's to Clayton Brook, or to have the length tar-sprayed; also that the Chorley-road be reconstructed at a cost of £17,950, and that application be made to the county council to proceed with the work.

Westminster B.C.—It has been decided to repave Coventry-street, Cranbourn-street, Leicester-square (north side), and New Coventry-street with wood blocks, at a cost of £5,467. The Works Committee had submitted a recommendation that asphalt paving should be laid down, involving an outlay of £4,797. It was stated that one result of the war had been that the cost of wood paving had gone up and that of asphalt had gone down.

Worthing T.C.—The borough surveyor, Mr. F. Roberts, has received instructions to prepare an estimate of the cost of surface improvement in Broadwater-road, Warwick-street and Chapel-road.

SEWERAGE AND SEWAGE DISPOSAL.

Aldershot U.D.C.—Surface-water drainage works are to be carried out at an estimated cost of £210.

Arundel T.C.—It has been decided to purchase a new sludge pump for the sewage disposal works.

Ashby Woulds U.D.C.—The Sewerage Committee recommend that the sewage scheme estimated to cost £1,400, should be proceeded with, subject to the question of patent jointed pipes being considered later.

Bacup T.C.—A scheme for the sewerage of Booth-road has been approved.

Chester-le-Street R.D.C.—A scheme has been adopted for the construction of a sewer from Birtley to Gateshead, at an estimated cost of £1,302.

Coalville U.D.C.—The Local Government Board in a communication have drawn attention to the large number of conservancy closets in the district and the slow rate of conversion to the water-carriage system. The results of the general adoption of the latter system, in the board's experience, reflected improved figures as to sickness and mortality. In the circumstances, the surveyor, Mr. L. L. Baldwin, has received instructions to report at the next meeting cases where the question of conversion could be considered.

Coventry T.C.—A scheme has been approved for extensions at the sewage disposal works which are estimated to cost £5,000.

Doncaster T.C.—The borough surveyor, Mr. F. O. Kirby, has completed the draft conditions for the proposed competition for the sewerage and sewage disposal scheme, and the Institution of Civil Engineers will be requested to nominate the assessor.

Falmouth T.C.—An application is to be made to the Local Government Board for sanction to borrow £320 for the carrying out of the Market Strand sewerage scheme.

Fareham U.D.C.—The Local Government Board have expressed approval generally of the scheme for sewerage and sewage disposal works. The estimated cost is £15,240.

Helston R.D.C.—The surveyor, Mr. R. J. Wearne, has received instructions to prepare plans in connection with the Knan Moor drainage scheme.

Rowley Regis U.D.C.—The Local Government Board have authorised the council to borrow the sum of £345 (being part of a sum of £734 sanctioned on June 18, 1912) for carrying out the necessary work of relaying sewers at Wright's-lane, Lion-road, and Cherry Orchard-street.

Surbiton U.D.C.—The council last week accepted the offer of the Amalgamated Society of Engineers for a loan of £4,000 in respect of excess expenditure on the sewage disposal works. Whereas by the terms of sanction of the Local Government Board the principal and interest must be paid back in six years, the society offered a period of twenty-eight years, at 4½ per cent interest.

Swindon T.C.—The council have approved an amended scheme by Mr. Midgley Taylor for improvement at the sewage disposal works, which are estimated to cost £25,205.

Westhoughton U.D.C.—Sewerage extensions are to be carried out at an estimated cost of £310.

WATER, GAS, AND ELECTRICITY.

Bradford T.C.—The Electricity Committee recommend the town council to obtain a further loan of £20,000 for electrical extensions.

Chesterfield T.C.—The Local Government Board have asked the council to submit particulars of the proposed new works in connection with the electricity undertaking, in respect of which a loan of £5,000 has been applied for.

Driffield R.D.C.—Tenders have been invited for carrying out the proposed works of water supply for Foston at an estimated cost of £180. The Local Government Board have sanctioned a loan for the work.

East Dereham U.D.C.—Tenders are to be obtained for a new and a second-hand extractor for the gas-works.

Glasgow T.C.—The Health Committee recommend that £1,000 be contributed towards the cost of providing an improved water supply at the Ochil Hills sanatorium, and the enlargement of the septic tanks.

Long Eaton U.D.C.—The Lighting Committee have been asked to report upon the subject of street lighting.

Wokingham T.C.—The corporation are taking up a loan of £345 for the purposes of the gas undertaking.

Worcester T.C.—A letter from the Local Government Board was read, referring to the council's application for sanction to borrow £9,875 for additional filters and the removal and reerection of the sand-washing plant, and £360 for the purchase of land adjoining the waterworks, and stating that the board regarded the proposals as generally satisfactory, although they remained of the opinion expressed in their letter of May 5, 1914, as to the desirability of providing for the storage of water prior to filtration,

and stating that the use of the valves in the bell mouthed pipes in the filtered water tank was open to serious objection, as it might lead to practically unfiltered water being mixed with the filtered water owing to the rupture of the filtering film. Before giving their decision on the application they desired to be furnished with an undertaking by the council that the use of those valves would be abandoned when the new filters were completed and in operation; and, further, should it still be found necessary to continue to work the filters with a greater head than 2 ft. 6 in., that either additional filters should be constructed or pre-filtration storage provided. The Water and Sewerage Committee recommend the council to give an undertaking to the Local Government Board that the use of the valves in the bell-mouthed pipes in the filtered water tank at the waterworks will be abandoned when the new filters are completed and in operation, and that, if it should be found necessary to continue to work the filters with a greater head than 2 ft. 6 in., either additional filters will be constructed or pre-filtration storage provided.

MISCELLANEOUS.

Abercarn U.D.C.—The medical officer states, in his annual report: "It is a great pity that the wide powers given to local authorities by the various Housing Acts are not exercisable owing to the council's limited opportunities." Dr. Griffith recommends among other things the laying of sewers to the Trinant and Kendon districts, the building of more council houses, the connections of private premises to the sewers, the provision of a refuse destructor, the prevention of the pollution of Kendon Brook and Torlais Stream, and the liberal supply of disinfectants. He points out that the new trunk sewer of the Western Valleys Sewerage Board has done more than anything else for the health of the district.

PERSONAL.

Mr. P. Grant McGregor, Glasgow, has been appointed burgh surveyor and inspector of Moffat.

Mr. F. L. Burch, surveyor and inspector to the East Dereham Urban District Council, has been voted an increase of salary.

Mr. T. H. Hailstone, surveyor and inspector to the Birstall Urban District Council, has had his salary increased by £20 a year.

Mr. J. H. Castle, engineer and surveyor to the [illegible] Urban District Council, has had his salary increased by £50 per annum.

Mr. Vincent Davison, of Liphook and New Malden, has been appointed temporary assistant surveyor to the Maldens and Coombe Urban District Council.

Mr. A. J. Blight, surveyor to the St. Austell Rural District Council, who recently underwent a severe operation, is, we are pleased to say, making good progress.

Mr. Walter Senior, on leaving Liversedge to take up an appointment as assistant to the borough surveyor of Burton-on-Trent, has been presented with a kit bag by his old colleagues.

Mr. Roderick McDonald, assistant road surveyor, has been appointed road surveyor by the Northern District Committee of the Ayrshire County Council, in succession to the late Mr. John Armour.

Mr. Norman Scorgie, borough engineer and surveyor of Hackney, has been appointed deputy town clerk until September 30th, during the absence of the town clerk, Mr. William Alfred Williams, owing to illness.

Mr. A. O. Harpur, surveyor to the Caerphilly Urban District Council, who has resigned to take up an appointment at Hull, was on Friday last presented with a framed photographic group of the Caerphilly staff.

Mr. Edmond P. Burke and Mr. James J. Dowd, members of the Dublin city surveyor's department, have been appointed to two vacant junior engineerships in the office on condition that they obtain the qualifications required by the borough surveyor within twelve months.

Mr. R. W. Furniss, architectural assistant in the Bradford borough surveyor's department, has been appointed by the Health Committee clerk of works in connection with the proposed sanatorium at Thingwall, at a salary of £180 per annum, with £10 travelling expenses.

From the *London Gazette*: "Regular Forces. Royal Regiment of Artillery, R.H. and R.F.A. Second Lieutenant H. B. T. Wakelam, from 2nd London Regiment (Royal Fusiliers) (University candidate), to be Second Lieutenant." The above-named is the only son of Mr. H. T. Wakelam, county engineer of Middlesex.

The chairman of the Gloucestershire County Council, Mr. M. W. Colchester-Wemyss, referring recently to the funeral of the late county surveyor, Mr. R. Phillips, which he attended, spoke of the valuable services Mr. Phillips had rendered to the county. He said Mr. Phillips had been connected with the county many years before the county council came into existence, for he came there first as county surveyor in 1876. The chairman said he would like to bear his most ready testimony to the fact that the county had had in Mr. Phillips an extremely able and efficient officer. He was a very clever engineer and surveyor, and a most conscientious county official. Sir Ashton Lister and Mr. Jenner Fust endorsed these remarks.

FOR OTHER ADVERTISEMENTS
See End of Paper.

FOREMAN, HIGHWAYS DEPARTMENT. Borough of Newcastle-under-Lyme. 35s.—£2 2s. per week. Particulars of duty on application.

A. A. PATTISON,
(2,638) Borough Surveyor.

LEATHERHEAD URBAN DISTRICT COUNCIL.

The above Council are prepared to receive Tenders for the Delivery at Leatherhead Station of about 400 tons of Tar-macadam of Hard, Blast-furnace Slag of the undermentioned sizes:—

Approximate quantities:—
106 tons Bottoms, 2½-in. to 1½-in.
258 tons Toppings, 1½-in. to ½-in.
50 tons Fine, ⅜-in.
10 tons Slag Dust.

Prices, at per ton, to be delivered to me by 4 p.m. on Tuesday next, July 20th, 1915, endorsed "Tender for Tarmac." Sample of Material to be sent with Tender.

Tender to state how soon Material could be delivered.

The Council do not bind themselves to accept the lowest or any Tender.

SIDNEY R. DRAKE,
Surveyor.

Council Offices,
Leatherhead.
July 14, 1915. (2,637)

TWICKENHAM.

TWICKENHAM URBAN DISTRICT COUNCIL.

PRIVATE STREET IMPROVEMENT WORKS.

The above Council hereby invite Tenders for the Works in connection with Forming, Levelling, Paving, Metalling, Kerbing, Channelling, and Making Good portion of a certain street known as Cambridge-road (Section 3), within the district of Twickenham.

Plans and Specifications may be seen, and Form of Tender obtained, on application at the Office of Mr. Fred W. Pearce, F.S.I., Surveyor to the Council, Town Hall, Twickenham, and the payment at my Office of a deposit of One Guinea, which deposit will be returned on receipt by the Council of a *bonâ-fide* Tender.

Sealed Tenders, endorsed "Tender for Street Improvement Works, Cambridge-road (Section 3)," to be delivered to the undersigned not later than Noon on Wednesday, the 21st day of July, 1915.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
H. JASON SAUNDERS,
Clerk to the Council.

Town Hall,
Twickenham.
July 1, 1915. (2,639)

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING IN LONDON—(4).

In last week's issue we printed papers submitted by Mr. J. A. Webb, engineer and surveyor to the Hendon Rural District Council, and Mr. N. Greenshields, borough engineer and surveyor of Bedford, at the recent annual meeting of the Institution of Municipal and County Engineers in London. To Mr. Webb's paper, we may recall, an account was given of his experiences in the maintenance and resurfacing of roads, particularly on a clay subsoil in the vicinity of the Metropolis, while that of Mr. Greenshields dealt with the preparation and laying of tar-macadam on roads in Bedford.

Mr. H. PERCY BOULNOIS (Westminster) said the whole question of roads, and particularly of rural roads, was extremely interesting. Any papers they could get on actual experiences were most useful. There were, no doubt, many men present who could tell them of their actual experiences. That was what they required—the Road Board particularly. He was a member of the Road Board Advisory Committee, and what they wanted now were papers of this character telling them actually of their experience—what they had done, what the cost had been, and the result. There was no panacea, no Royal road to road engineering. If there were the country would not require any road engineers. The road engineer must use his brains in connection with this subject. A good deal of money was wasted on the roads in material. Skilled labour could be employed on many roads with much better results. It was not always the material, but the skill with which it was employed, and the skill with which the road was maintained. He had noticed that frequently, and he felt that material was expended on a road where labour would do all that was wanted. There were a great number of failures throughout the country, and if men who had made those failures would only tell them, and how they thought those failures had arisen, they would learn a great deal. There was the case of Sutton, near London, where roads on a bituminous system had been made as they were made hitherto, and they had failed. The Advisory Committee were going there shortly to inspect those roads, and, if possible, to find out why there had been the failure. He did implore them to register failure, and to give what they considered to be the reasons for the failure.

Mr. H. GILBERT WHYATT (Grimsby) said the methods of Mr. Greenshields were exactly those on which he had been working for the last seven years. He had found a sort of feeling on the part of his council that hand-mixed stuff would keep the wages in the town, whereas the machine-mixed stuff was bought, and the cost of the wages spent in mixing would be spent in some other town than Grimsby. So his council decided they would use none but hand-mixed material. Mr. Greenshields had found his hand-mixed material to be far stronger and infinitely better suited for use than machine-mixed material. He could not make any comparison, because he had only a few trucks of the machine-mixed stuff; but he could say that the hand-made stuff was absolutely good. He noticed that Mr. Greenshields had used a small quantity of pitch—15 lb. to 3,570 gallons of tar. He used 15 lb. to 200 gallons of tar, so he used ten times as much pitch as Mr. Greenshields. The price given of 2s. 9d. per square yard was slightly above his price. In 1913 he could do it at 2s. 7½d. per square yard, including the extra quantity of pitch mentioned. He was exceedingly pleased to think that some other engineer had adopted the same method as he had adopted—or, to put it the other way about, that he had adopted what someone else had been using.

Mr. A. E. COLLINS (Norwich) remarked that on the roads which he was responsible for he had had some extraordinary experiences. They had laid a considerable quantity of bituminous macadam. It was very successful until the winter was over; then the road fell to pieces. The bitumen seemed to be of the same quality all through, though there was no chemical analysis made of the material. Many of the roads which were thoroughly successful fell to pieces. Another peculiarity this year was with tar-macadam. Tar-macadam laid in the best way he thought possible to lay it, so soon as the hot weather came the tar was spewing all over the road surface. He had never had such an experience as this before.

Mr. COOPER (Kent) said no reference appeared to have been made as to what was the underlying cause of Mr. Webb's paper, the making of roads on a clay subsoil. Anyone who had to do with rural roads and narrow roads where they got motor-traction traffic knew it was a source of great trouble. He took off a corner of a road, put in a substantial foundation, topped it with Kentish ragstone, and got the work completed, when along came the water company and put their trench through the junction of his old and new pieces. The next time they had the War Office carrying heavy traffic, and bringing him trouble again. The new length began to lift, and every time traction engines came along it became worse. He did the road twice with no better results. He put it to his county that the road would have to be done thoroughly, as the clay was coming up to the surface, and it required a good deal of labour and a good deal of expense. The cost of the road worked out at 4s. per yard, but it had stood well since. He urged his council to make a claim against the War Office, and they managed to recover one half of the cost. That was a small experience of dealing with clay when it got through the top of a road.

Mr. J. D. HARWARD (Worcestershire County Council) wished to ask one or two questions of Mr. Webb. In his paper he gave his experience of an experiment in road making, which worked out at 3s. 4d. per yard super. The figure seemed a little high for the work done. Then Mr. Webb gave an interesting experience of a section of road which lasted six years. That seemed satisfactory on the face of it. Could he say approximately what amount of traffic the road carried? It was gratifying to find that the Clee Hill stone had such a good reputation.

Mr. A. GLADWELL (Eton Rural) said, as an old friend of Mr. Webb, and one who had somewhat intimate acquaintance with the condition of things as to highways when Mr. Webb entered upon his present duties twenty years ago, he could speak of the tremendous improvement which had taken place in the condition of his roads—an improvement which was more or less recorded in his paper. It was perfectly obvious that there was scarcely any element in road construction which was more difficult to deal with than that of having to maintain a road on a clay subsoil. He believed that the president had an intimate acquaintance with that, as Mr. Webb's district was in his area of administration. They had not only the difficulty of a clay subsoil, but that of gradient, and roads being cut out with high banks on either side, and the impossibility of effecting satisfactory under-drainage. He was glad to see Mr. Webb pointed out the practical things he had adopted to overcome those difficulties. He had strengthened the shoulder of many of his roads in many instances instead of reconstructing the foundation across the whole width. He had found great advantage in following this system. It formed an abutment for the crown of the road, and if they could waterproof the surface of the road by simple tar treatment they kept the water from entering into the foundation of the road, and so in time it held up against the traffic, which without these remedies it would be utterly incapable of doing. He thought Mr. Webb's paper was interesting in many respects. It was also, as Mr. Boulnois intimated, important that those who were interested in this question should be as perfectly frank as to failures as to successes. A man's failures would not only instruct himself, but, communicated to others in a fair and frank manner, would prevent them making similar mistakes. They all had failures. As Mr. Boulnois said, no one method was applicable to all circumstances; and he thought the interchange of ideas, and always being unashamed of their failures, should be of great value to the elucidation of this important question. He congratulated Mr. Webb upon his paper, because it had been prepared with great thought and study, and would be a valuable addition to their "Proceedings."

Mr. WEBB, in reply, returned thanks for the remarks which had been passed respecting the paper. What he did was to prepare a few notes for one of their district meetings, and they had a discussion which was thought a good deal of, and from that this paper was written. In dealing with the making of

roads generally on a clay subsoil, only those who had to do it could realise the trouble it was. In ordinary roads, such as there were in most counties, and particularly of roads which were now in semi-urban areas near London, the roads were never properly constructed, and the difficulty was now realised when one considered the amount of heavy mechanical traffic the roads were subjected to. He would only refer them to statistics which were prepared in July last of traffic over a road in his district. If they took the total weight of the tonnage passing over it seemed incredible, but it was a fact. That answered the question as to the amount of traffic passing over that road. There were two omnibus routes over that road, with a quarter of an hour service, so they could tell that there was a considerable amount of traffic more than on an ordinary district road. He might say, in passing, that he was exceedingly sorry his friend Mr. Greenshields was not there, as he was responsible for getting him to write the notes which he had given that day. He prepared them for a meeting in Bedford. If any member was in that neighbourhood he would strongly advise him to look at the roads. They were mostly made with slag, and they were, generally speaking, in excellent condition. He went with Mr. Greenshields into the question of cost. The slag, which was of an exceptional description, very good indeed, with scarcely a honeycombed piece in it, was stored into a shed directly it arrived at the station, was kept dry, taken into the works, and everything done by hand. He must qualify that to this extent. If they looked at the wages and compared them with most of their districts, they would find them lower. Therein lay the secret of the whole thing. In rural areas they knew the difficulty in preventing the road spreading. He found this method the best way of dealing with that difficulty—that was to take out 5 ft. or 6 ft. on either side of the road, fill in with hard core and consolidate in a proper manner, and then resurface it so as to make it as near watertight as they could. That was the best and most economical way of dealing with a road on a clay subsoil which had to carry a large amount of traffic. They must try to keep the water away from the subsoil. If they got potholes it would make it worse, because the soft clay would work through. Mr. Cooper, of Kent, referred to damage on a newly made road by a water company. He had a similar experience. He took it out sufficiently deep to put in a layer of cinders or ashes 3 in. or 4 in. deep on the clay, put in a drain, and then resurfaced it. He was not in favour of using faggots, as they rotted, and then there would be corrugated surface.

(To be continued.)

COUNCIL MEETING.

At the last meeting of the council of the Institution of Municipal and County Engineers there were present: Messrs. J. S. Pickering (president, in the chair), William Blair, H. Percy Boulnois, Charles Brownridge, E. E. Wallington Butt, G. F. Carter, J. W. Cockrill, Arthur E. Collins, P. Dodd, R. H. Dorman, Ernest J. Elford, A. D. Greatorex, W. Harpur, T. W. A. Hayward, W. T. Lancashire, Sir James Lemon, Joseph Lobley, L. S. McKenzie, Frank Massie, E. George Mawbey, Thomas Moulding, P. H. Palmer, George A. Phillips, W. B. Purser, Leslie Roseveare, Norman Scorgie, Allan Stevenson, Henry E. Stilgoe, William Stubbs, R. J. Thomas, H. T. Wakelam, James A. Webb, Edward Willis, O. E. Winter, the consultant secretary and the secretary.

THE MEMBERSHIP ROLL.

The following candidates were elected:—

Members: Messrs. J. E. Aldersley, engineer and surveyor, Earby Urban District Council; C. G. Atkinson, surveyor, Chertsey Rural District Council; F. W. Bricknell, city engineer, Hull; W. C. Copperthwaite, assistant engineer, London County Council; G. H. Davies, deputy engineer, Pontypridd Urban District Council; W. H. Ellacott, road surveyor, Midlothian County Council; T. Grime, surveyor, Formby Urban District Council; J. E. Johnston, surveyor and water engineer, Bedlingtonshire Urban District Council; H. G. Warne, surveyor and engineer, Kingswood Urban District Council; and H. P. G. Young, district engineer, Public Works Department, Ceylon.

Associate Member: Mr. J. A. H. Burford, assistant surveyor, Newmarket Urban District Council.

Transfer from Student to Associate Member: Messrs. H. Cliffe, assistant surveyor, Mexborough Urban District Council; and P. Harrison, assistant engineer and surveyor, Middleton.

NORTHAMPTONSHIRE ROADS.

POINTS FROM COUNTY SURVEYOR'S REPORT.

Quoting in his report for the year 1914-15 the figure of 329·87 as the mileage of main roads in the county of Northamptonshire, Mr. Charles S. Morris, the county surveyor, says: "The mileage given is compiled from the list which I found in existence when I took up my appointment, this probably being taken from the lengths furnished by the Turnpike Trustees. I have measured several of the roads, and find that the lengths stated are more or less inaccurate in every case, and I hope during the current year to get the remainder measured, and the list corrected. Some of the mile-posts are in wrong positions, and these will be moved to their correct places."

The weather during the summer and autumn was generally dry and favourable, and in consequence the work of resurfacing the principal roads was considerably advanced. The winter, however, was exceptionally wet and detrimental to the roads.

The increasing motor traffic stripped the surface of many of the roads, and a large amount of patching material was required. The maintaining of a true surface on the heavier trafficked roads is becoming increasingly difficult, and Mr. Morris expresses the view that nothing short of resurfacing with grouted material or tar-macadam will successfully maintain a true surface under modern traffic.

The Tarvia grouting work has been continued, and during the year 7·3 miles were recoated and grouted, making a total mileage up to date of 53·64. This is exclusive of the London-Holyhead road (Watling-street) reconstruction and certain 'bus routes.

MAINTENANCE COSTS.

The total cost of maintenance, exclusive of improvements and Road Board works, but including repayment of steam-roller loans, was £23,062 gross and £22,869 nett. Improvements cost £1,076 gross and £1,016 nett. Road Board works (including Watling-street and 'bus routes) cost £39,956 gross and £13,036 nett.

The total cost of the whole of the works on the county main roads was £64,095, and the nett expenditure £36,922. The total cost amounts to £201·63 per mile, and the nett cost to the council £116·15 per mile.

The estimated expenditure for the current year is £50,164 gross and £31,668 nett, or £157·81 and £99·62 per mile respectively.

In comparing these figures with previous cost the fact that the cost of reconstructing a large mileage of the roads is included must not be lost sight of, as this work adds materially to the average cost per mile.

A total quantity of 17,970 tons of granite chippings, 1,301 tons of tar-macadam, and 578 tons of slag and slag chippings was purchased during the year, and the greater part was applied to the roads. Four steam rollers have been regularly at work (except when stopped for repairs), and four additional rollers were hired. The total quantity consolidated by the county rollers (exclusive of Road Board work) was 15,664 tons, at a cost of £456 17s. 3d., or 7d. per ton.

The existing gravel and ashed footpaths have been repaired where necessary, and over £266 was expended on materials.

Further progress has been made in providing new kerbing in villages and renewing the paved and asphalted footpaths, a total sum of over £521 being spent on this work.

On the roads directly maintained, the cost of maintenance (exclusive of Road Board work) worked out at £58·46 per mile gross, and £57·69 per mile nett.

MOTOR-'BUS ROUTES.

The work of widening and resurfacing the roads traversed by motor omnibuses was in hand throughout the year. The greater part of the widening has been completed, and 13·36 miles recoated with grouted granite and tar-macadam out of a total length of 29·52 miles. The estimated cost of the work is £41,625, towards which the Road Board have given a grant of £13,500 and a loan of £15,000 free of interest. The expenditure for the year amounted to £21,664, and it was hoped to complete the work during the current year. Owing, however, to the difficulty in obtaining a sufficient supply of materials and labour, it is probable that the work will not be completed until 1916.

During the four years ended March 31st last the total amount expended upon Road Board work and improvements was £71,798, the nett cost to the council being £37,014, of which £20,000 has been provided by loan (free of interest) to be repaid in five annual instalments.

CORRESPONDENCE.

Ἐς ἀνὴρ οὐ πάντ' ἀρά
(*One man does not see everything.*)
—EURIPIDES.

REFUSE DESTRUCTOR CLINKER ROADS.

To the Editor of THE SURVEYOR.

SIR,—In your weekly column headed "Things One Would Like to Know" there have appeared recently interesting notes on the construction of roads from dust destructor clinker.

While in no way wishing to enter into competition with other surveyors who may claim priority in its use, I may mention that in Beckenham roads have been surfaced with this material for the past eight years. From 1,000 to 1,500 sup. yds. of tarred clinker have been placed on the roads each year, with a result that we now have about 4 miles of road surfaced with that material.

The roads so treated are chiefly by-roads, with good foundations, but on which the traffic is not heavy, and the results have been eminently satisfactory. Incidentally, I may mention that we have been able to discontinue the watering of some of such roads and in others greatly to reduce it.

I have no doubt that there are many other districts in which dust destructor clinker is now used for road making, and it would be interesting if the discussion on the matter initiated by you were continued by surveyors having practical experience in the use of dust destructor clinker.

To put in practice my suggestion, I give the following brief particulars of its manufacture, &c., in the district of Beckenham.

The clinker is passed through a crusher and the dust and small clinker removed, the former being sold for use in mortar and the latter in concrete. The residue, varying in gauge from 2½ in. to 1 in., is thoroughly mixed with gas-tar (to which a small amount of pitch is added) in a proportion of 14 to 16 gallons per cubic yard, and heaped in the open. The tarred clinker, after maturing for three or four months, is again freshened with about 2 or 3 gallons of tar per cubic yard prior to its being placed on the road. The thickness spread is 6 in., consolidated to about 3½ by rolling with a 10-ton steam roller.

Various top dressings have been used, such as limestone tar paving, granite chippings, &c., the best result having been obtained from tar paving ¾-in. to ½-in. gauge, spread to a thickness of ½ in. and thoroughly rolled.

A road so made has a smooth surface, is thoroughly watertight, has a fair wearing capacity, and costs in this district about 2s. 3d. per super. yard for a consolidated thickness of 3½ in.

The plant used in preparing the tar clinker consists of a crusher, with screens, supplied by Messrs. Horsfall & Co., and a Smith's mixer, supplied by Stothert & Pitt, Limited—both driven by an electric motor.—Yours, &c.,

JOHN A. ANGELL.

Surveyor's Department,
Beckenham.
July 12, 1915.

[Mr. Angell's letter is a most valuable contribution to this discussion, and we hope that other surveyors will favour us with their experiences.—Ed. SURVEYOR.]

CLASSIFICATION OF BITUMENS.

To the Editor of THE SURVEYOR.

SIR,—The articles and correspondence that recently appeared in your columns on the subject of the classification of bitumens are very interesting to us on this side of the water. It is pertinent, I think, to call attention to a statement which appeared in the issue of THE SURVEYOR for May 1, 1914, as follows:—

"A lot of confusion and misunderstanding would be saved by dropping the word 'bituminous' altogether. Such terms as bituminous, asphaltic, &c., are generally attached to materials that are inferior to either bitumen or asphalt and require 'puffing.' Tar and pitch treated roads are invariably described as bituminous roads, but this is a most misleading term, and there is no need for it whatever. It is not necessary to refer to a natural bitumen as 'bituminous,' as that is the genuine article itself."

The truth in regard to this matter is that those who are seeking to have residual pitches—in fact, almost anything that is black and sticky—classified as asphalt or described as bitumen, are actuated mainly by the desire to secure the application of a flattering name to a product that is not really entitled to it. It is not necessary to go into the merits of the various products concerned, but it is necessary to emphasise the fact that they are *different*, and that nothing but confusion can result through the attempt to lump together differing materials under one general term.

The writer of the letter in your issue of May 28, 1915, says it has never been explained why objection is made to the term "petroleum pitch," nor why the effort is made to have this material described as bitumen. The reason, put in the plainest possible words, is that as "bitumen" petroleum residues can masquerade as the highest-class products, and more money can be obtained for them if the line of demarcation as between natural bitumen or natural asphalts is broken down.

In this connection it may be interesting to your readers to know that, according to official nomenclature in Germany, the term asphalt is applied only to the natural products, such as the Trinidad and Bermudez lake asphalts. The statement of Professor Holde, of the Imperial Laboratory, Berlin, on this subject is as follows:—

"In order to arrive at a uniform terminology for pitchy and asphaltic substances it is desirable to reserve the name 'asphalt' for such products as are found in nature. . . . The substitutes (to be regarded as inferior) which result from the working up of petroleum should be designated 'artificial asphalts,' or, better still, pitches, such as petroleum pitch, grease pitch, brown coal-tar pitch, coal-tar pitch, &c., according to their origin."

In this country we have the same effort that is pursued in England to classify all asphaltic binders under one name, and sometimes under one specification. In this way the highest-priced products are mixed up with the lowest-priced products, and a monopoly is conferred upon cheapness as distinguished from merit. But, if I may repeat, I think this whole subject was completely summed up by the statement made in THE SURVEYOR more than a year ago and quoted above.—Yours, &c.,

DANIEL T. PIERCE,
Executive Assistant,
Barber Asphalt Paving Company.

Land Title Building,
Philadelphia.
June 10, 1915.

ROAD MAKERS AND ROAD USERS.

To the Editor of THE SURVEYOR.

SIR,—One is somewhat diffident in suggesting the formation of another society in these days, but the discussion on some of the papers at the recent National Road Conference points to the necessity of better co-operation between road makers and road users, so that the demands and ideas of the one may be brought more into touch with the requirements and commercial possibilities of the other. The science of road making not only involves the knowledge of the road engineer, but also that of the analytical chemist, the quarry owner, the manufacturer, the specialist in road machinery, the motor manufacturer and user, the petrologist, the geologist, and others whose business or profession is closely bound up with the making and using of roads. The formation of such a society was suggested by me some time since in the columns of one of the technical journals, and from letters I received a certain amount of support was forthcoming. I, however, now make a wider appeal through the columns of your paper, and shall be pleased to hear from any one interested in the matter, when I would call a meeting so that the society might be inaugurated on a proper basis. Good results I am sure would accrue from such a course.—Yours, &c.,

REGINALD BROWN, M.INST.C.E., M.I.MECH.E., F.S.I.
21 Old Queen-street, S.W.
July 10, 1915.

MUNICIPAL ENGINEERING WAR-TIME APPOINTMENTS.

To the Editor of THE SURVEYOR.

SIR,—Noticing that you propose to register gentlemen of military age where they have valid reasons for not being on active service, may I ask the favour of registration?

I am at present chief assistant to a Westminster firm of civil engineers and surveyors. The war has made it necessary for them to reduce staff, and they

have asked me to seek a new appointment until the [illegible] of service, when they will be glad to take me [illegible].

I am of military age, but cannot offer myself for active service, as I am married, have a wife in a delicate state of health, and have no private means to keep my home going in my absence.

I am a thoroughly good surveyor and draughtsman, and am quite familiar with all the common (and most of those that cannot be so described) surveying instruments and methods of surveying. I am well up in sanitary work, municipal law, road making, and town planning, and have some knowledge of building.

I passed my "Final" for the Surveyors' Institution (sub-div. ii.) in 1908, and in 1910 was granted their Special Diploma in Sanitary Science—an excellent examination covering nearly all the subjects of the Municipal and County Engineers' examination.

In addition to my professional education, I have had an excellent business training, and am competent to control an office staff, dictate business correspondence or professional reports, and undertake similar general office routine.—Yours, &c.,

M. C. H.

July 7, 1915.

To the Editor of The Surveyor.

Sir,—I have to thank you for the promptness with which you have dealt with my application in your issue of the 2nd inst. *re* the above. I have taken The Surveyor for over fifteen years, and I think that the success which your paper has attained is in no small measure due to your willingness to help in periods of stress.

I have offered my services to the Royal Arsenal, Woolwich, the Minister of War Munitions, and a number of armament boards, but in each case my application has been unsuccessful.—Yours, &c.,

R. A. W.

KILLED IN ACTION.

MR. GEORGE ALLAN BARFOOT.

Mr. George Allan Barfoot, first engineering assistant in the Islington borough engineer's department, was killed in action on the 21st ult. He held the rank of 2nd Lieutenant in the 3rd Worcestershire Regiment, having been promoted from sergeant in the 1st Battalion of the Artists' Regiment. The borough engineer and surveyor of Islington, Mr. J. Patten Barber, M.Inst.C.E., in the course of a letter to the mayor, wrote:—

"He was twenty-nine years of age, and had been in the council's service nine years. He was an exceedingly capable engineer, with an all-round experience, very steady and reliable, very strong and very patient, courteous, and tactful. He was greatly respected and loved by his colleagues in every department of the council's service, and he was a clean, bright, manly gentleman, a vigorous athlete, a fine shot, and in every respect a true Englishman."

Irish Bills in Parliament.—The Provisional Orders of the Irish Local Government Board empowering the urban district councils of Armagh and Lisburn, and the rural district council of Dungannon to take lands compulsorily for a water supply, and enabling the rural district of Carlow to take lands compulsorily for new burial grounds, have passed the Committee on Unopposed Measures, and the confirming Bill has been ordered for third reading in the Commons.

Ambulance Service for London.—The establishment of this service by the London County Council is proceeding rapidly. The ambulance station at North End-road, Fulham, was opened for service on February 1st. The station at Boundary-street, Shoreditch, equipped with two motor ambulances, was opened on Monday, June 21st. The station at St. George's Market, London-road, Southwark, will be open for service within a few weeks from date, and the remaining stations at Herbrand-street (Bloomsbury), Acre-lane (Brixton), and Lee High-road, will successively be available within the next two months. An essential feature of the ambulance scheme for London is the user by the police in uniform, for the purpose of summoning ambulances, of private telephones, an indicating tablet being placed upon premises where telephones are, by the courtesy of the occupants, available for the purpose.

NORFOLK ROADS AND BRIDGES.

COUNTY SURVEYOR'S REPORT.

The total length of main roads in Norfolk is over 1,414 miles, according to the latest report of Mr. T. H. B. Heslop, M.Inst.C.E., the county surveyor. There are 656 bridges and culverts. The total ordinary expenditure on main roads during the year ended March 31st last was £70,827, being a decrease of £2,785 as compared with the previous year. The total expenditure on bridges and culverts, including flood damage, was £9,807, being a decrease of £9,856 on the previous twelve months. The sum of £1,214 was expended upon improvements, such as new footways, fencing, milestones, direction-posts, stormwater gullies, drainage and kerbing. The sum of £6,489 has been expended on road tarring.

The total cost per mile for ordinary maintenance, including all items, such as materials, team labour, manual labour, management, steam rolling, tools, stationery, and repairs to footpaths, but excluding improvements and repayments, was £48 18s. 4d.

The condition of the main roads generally is stated by Mr. Heslop to be good, taking into consideration the very wet winter which was experienced. It is now, however, quite evident that with the constantly increasing motor and general heavy traffic, local materials are quite unsuitable for the important roads, either from the points of view of efficiency or economy.

During the past winter Mr. Heslop has carried out for the War Office the strengthening and reconstruction of certain roads for military purposes, and the construction of inter-camp roads and paths at the various camps in the county. This work is now rapidly approaching completion. Considerable damage has been done to the main roads in certain areas by the military traffic.

A scheme for the improvement of road surfaces has been approved by the Road Board, and grants on favourable terms are promised.

Surface tarring in the principal towns and villages has again been carried out to the evident satisfaction of the public; 117 miles of road were treated, as against 100 miles in 1913. There continue to be a great many applications for extensions from all parts of the county; 117 miles of road are again being tarred this season, the Joint Tarring Committee having decided to adopt the 1914 schedule.

In addition to this, the whole of the 17½ miles of road reconstructed under the Road Board free gift grant will again be retarred in 1915, and the 15½ miles of roads reconstructed under the 1914-15 grant will receive their first application of surface tarring, a considerable proportion of the cost being paid by the Road Board.

BRIDGES AND COUNTY BUILDINGS.

Repairs to bridges have been carried out as found necessary. The work of rebuilding Ludham Bridge is completed, and the roadway of the approaches is practically finished.

Mendham Bridge will very shortly be completed. Considerable delay was caused here owing to the difficulty the contractors experienced in finding erectors owing to the Government demands.

The county buildings generally are in good order, but Mr. Heslop draws the council's attention to the entire absence of any kind of fire extinguishing apparatus in the buildings. He adds that the county mental hospital has been taken over by the War Office as a war hospital, and that he is now engaged in carrying out very considerable alterations and additions to the buildings.

Proposed Midlands Sanatorium.—The General Purposes Committee of the West Bromwich Town Council recommend the council to join with the Corporation of Walsall in purchasing a site for the erection of a sanatorium and hospital. The one they recommend is about ¾ mile from Barr Beacon, with an area of 39 acres, and the price of the land is £30 per acre.

Heavy Motor Traffic.—The Surrey County Council are prosecuting owners of heavy motor vehicles who exceed the registered load of 8 tons on the back axle and 4 tons on the front one, and last week a further batch of offenders was haled before the county bench at Kingston. In one case the excess weight was 1 ton 2 cwt. 21lb., and the fine was £2, with £2 2s. costs.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

TEMPORARY ASSISTANT SURVEYOR.—July 21st.—Devon County Council. £3 per week. Mr. W. P. Robinson, county surveyor (No. 2 Division), 22 Queen-street, Exeter.

ROAD FOREMAN.—July 24th.—Penge Urban District Council. £2 per week, with free living quarters.—Mr. H. W. Longdin, surveyor, Town Hall.

SURVEYOR AND INSPECTOR.—July 27th.—Llandrindod Wells Urban District Council. £140 a year.—Mr. D. C. Davies, clerk, Town Hall, Llandrindod Wells.

SURVEYOR.—July 28th.—East Kerrier Rural District council. £80—£100 a year.—Mr. H. Truscott, clerk.

INSPECTOR OF NUISANCES.—August 3rd.—Holsworthy Rural District Council. £90 per annum.—Mr. C. Kinsman, clerk, Holsworthy, Devon.

HIGHWAY SURVEYOR.—August 4th.—Eastbourne Rural District Council. £200 per annum.—Mr. T. E. Varley Kirtlan, clerk, 92 Terminus-road, Eastbourne.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

COCKERMOUTH.—July 19th.—For taking down a chimney and removing the materials, for the rural district council.—Mr. J. B. Wilson, Grecian Villa, Cockermouth.

EDINBURGH.—July 19th.—For the erection of a generating station, for the corporation.—Sir Alexander Kennedy, 17 Victoria-street, Westminster, S.W.

KENT.—July 19th.—For the execution of repairs at Burham and other schools, for the Education Committee.—Mr. W. H. Robinson, architect, Sessions House, Maidstone.

RIPON.—July 19th.—For the erection of public conveniences, for the corporation.—City Surveyor.

KENT.—July 20th.—For painting and repairs to county buildings, for the Kent Standing Joint Committee.—County Architect, 86 Week-street, Maidstone.

LEEDS.—July 21st.—For building boiler-house, chimney and boiler seating, and supplying and fixing Lancashire boiler, for the corporation.—Mr. W. T. Lancashire, city engineer.

PORTSMOUTH.—July 22nd.—For building a shelter, for the corporation.—Borough Engineer.

HULL.—July 22nd.—For the builders' and ferro-concrete work in connection with the extension of boiler plant, for the corporation.—City Engineer.

TIVERTON.—July 24th.—For building a reinforced concrete retaining wall, for the corporation.—Mr. J. Siddalls, borough surveyor.

GLASGOW.—July 24th.—For relining chimney stalk with firebrick, for the corporation.—Mr. W. Greig, superintendent of cleansing, 20 Trongate.

FINCHLEY.—July 26th.—For the internal decorations of workmen's dwellings, for the urban district council.—Mr. C. J. Jenkin, engineer and surveyor.

WILTS.—July 26th.—For the erection of sanatoria, for the county council.—County Surveyor, Trowbridge.

SOMERSET.—July 28th.—For the rebuilding of Ham Bridge, consisting of the taking down of the existing bridge and erecting a new bridge with reinforced concrete, for the county council.—Mr. Edward Stead, county surveyor, County Council Offices, Wells.

SHEFFIELD.—July 30th.—For the erection of a pump-room at generating station, for the corporation.—Electricity Offices, Commercial-street, Sheffield.

MERTHYR.—August 9th.—For the erection of 160 workmen's dwellings, for the corporation.—Borough Architect, Town Hall.

WEST SUFFOLK.—For the erection of new offices at Haverhill, for the Education Committee.—Mr. A. A. Hunt, architect, 51 Abbeygate, Bury St. Edmunds.

Engineering: Iron and Steel.

WHITEHAVEN.—July 19th.—For the supply of iron castings, wrought iron, tools, cement, lead, oils, paints, coal tar, brushes, brooms, coal and coke, for the Harbour Commissioners.—Mr. J. Tyson, clerk.

DRIFFIELD.—July 20th.—For the sinking of two boreholes, for the rural district council.—Mr. H. Botterill, clerk, 23 Exchange-street, Driffield.

COWBRIDGE.—July 20th.—For providing and laying 727 yds. of 3-in. cast-iron pipes and valves, for the rural district council.—Mr. J. Stockwood, clerk.

MERTON.—July 23rd.—For the construction of a concrete culvert, for the urban district council.—Mr. G. Jerram, surveyor.

ROTHERHAM.—July 24th.—For the supply of smudge and pea nuts, cable, and meters, for the electricity department.—Engineer and Manager, Electricity Works.

MERTHYR.—July 26th.—For the supply of steel and cast-iron pipes, and for laying 3½ miles of pipe lines, for the corporation.—Sir Alex. Binnie, Son & Deacon, St. Stephen's House, Victoria Embankment, S.W.

DUBLIN.—July 26th.—For the supply of electricity cables and other works, for the corporation.—City Electrical Engineer.

GUILDFORD.—July 27th.—For the removal of old bridge and the construction of a new bridge, for the rural district council.—Mr. J. Anstee, engineer, Council Offices, Commercial-road.

SHEFFIELD.—July 30th.—For water-service conduit, screen chamber, penstocks, valves and piping, for the Electric Supply Committee.—Offices, Commercial-street, Sheffield.

RANGOON.—August 11th.—For the installation of a system of fire alarms, for the municipality.—Messrs. Ogilvy, Gillanders & Co., 67 Cornhill, London, E.C.

Gas and Electricity.

HULL.—July 22nd.—For the supply of turbo-alternator and a condenser outfit, for the corporation.—Mr. T. G. Milner, city treasurer, Guildhall, Hull.

Roads.

DURHAM.—July 19th.—For excavating, providing and laying reinforced-concrete foundations, and paving with granite setts on certain sections of main roads, for the county council.—Mr. Albert E. Brookes, county engineer and surveyor, Shire Hall, Durham.

WANDSWORTH.—July 19th.—For making up and paving part of Emsworth-street, Streatham, for the borough council.—Mr. P. Dodd, borough engineer, 56 East-street, Wandsworth.

TUNBRIDGE WELLS.—July 20th.—For the supply of 1,100 tons of granite or hard limestone chippings for road tarring, ⅜-in. to ½-in. gauge, for the corporation.—Mr. W. H. Maxwell, borough engineer.

CARSHALTON.—July 21st.—For the supply of 200 tons of 2½-in. and 100 tons of 1½-in. tarred slag macadam, for the urban district council.—Mr. W. Willis Gale, surveyor.

ISLE OF WIGHT.—July 21st.—For concrete paving works, for the rural district council.—Mr. L. A. Cozens, surveyor, Walmer Villa, Castle-road, Newport, I.W.

TWICKENHAM.—July 21st.—For making up a street, for the urban district council.—Mr. F. W. Pearce, surveyor, Town Hall.

LITTLE LEVER.—July 24th.—For the supply of road materials and labour, for the urban district council.—Mr. J. Seddon, surveyor.

RUISLIP-NORTHWOOD.—July 24th.—For the supply of 522 tons of bituminous granite, 217 yds. of hand-picked hardcore, and 330 tons of broken granite, for the urban district council.—Mr. Edmund R. Abbott, clerk, Council Offices, Northwood, Middlesex.

WESTHAMPNETT.—July 26th.—For steam rolling during the year, for the rural district council.—Mr. W. D. Rasell, clerk, 5 South-street, Chichester.

DOVER.—July 26th.—For the supply of Guernsey granite, Guernsey chippings, and Guernsey siftings, for the corporation.—Mr. R. E. Knocker, town clerk.

ROWLEY REGIS.—July 26th.—For raising a highway and constructing sewers, for the urban district council.—The Surveyor.

SCUNTHORPE.—July 26th.—For the supply of any quantity up to 400 tons of broken granite of approved quality, for the urban district council.—Mr. Herbert Heap, engineer and surveyor.

HIPPERHOLME.—July 26th.—For the supply of broken granite, chippings, and tarred road materials, for the urban district council.—Mr. G. W. Thompson, engineer and surveyor.

GLASGOW.—July 27th.—For constructing roads and drains, for the corporation.—Office of Public Works, 60 Candleriggs-street.

Sanitary.

BELFAST.—July 20th.—For the construction of pipe sewer and manholes, for the corporation.—City Surveyor.

KINSALE.—July 21st.—For the execution of drainage work, for the rural district council.—Mr. R. Evans, 53 South-mall, Cork.

MANCHESTER.—July 21st.—For the execution of drainage work, for the Guardians.—Mr. A. J. Murgatroyd, architect, 23 Strutt-street, Manchester.

BEDFORD.—July 21st.—For the construction of sewage disposal works and drainage, for the rural district council.—The Surveyor, 115 High-street, Bedford.

ROMFORD.—July 24th.—For the construction of manholes, for the urban district council.—Mr. T. H. Ridge, surveyor.

HAMILTON.—July 26th.—For the supply and installation of sanitary fittings and laundry and washhouse plant, for the Middle Ward District Committee.—Messrs. Sydney Mitchell & Wilson, architects, 13 Young-street, Edinburgh.

MELTON MOWBRAY.—July 27th.—For the construction of sewers and manholes, for the rural district council.—The Surveyor.

CANNOCK.—July 28th.—For the provision, laying and jointing of about 56 yds. of 9-in. pipes and 272 yds. of 9-in. stoneware sewers, and other incidental works, for the urban district council.—Mr. R. Blanchard, engineer and surveyor, Council Offices, Cannock.

HOWDEN.—For laying sewer and manholes, for the rural district council.—Mr. T. Dinsdale, Hailgate, Howden.

BILLERICAY.—For the collection of house refuse, for the rural district council.—Mr. S. J. Shelley, Junction-road, South Weald.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance. : Provisionally accepted.

GOOLE.—For the construction of shelter and [illegible] for the urban district [illegible]. M. J. B. Castle, engineer and surveyor, Goole:—

J. W. [illegible], Goole	£421
H. Featherstone, Goole	398
Jackson & Oates, Goole	396
J. Walker, Goole	385
Bailey Brothers, Goole*	371

Surveyor's estimate, £—.

ST. PANCRAS.—For installing heating apparatus in connection with the remodelling of the Princess-road school, St. Pancras, for the London County Council:—

[illegible]nson & Hebert, Peckham	£1,087
Brightside Foundry & Engineering Company, Limited, Victoria-street*	1,075
W. Freer [illegible]	1,040
J. Jeffs, Islington-road	1,010
Yetton & Brockett, Limited, New Kent-road	1,017
W. G. [illegible] & Co., Limited, [illegible]	975
[illegible] & Son, Kennington-road	957
W. Tyas and Sons, Sheffield	903

APPOINTMENTS OPEN.

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URBAN DISTRICT OF LLANDRINDOD WELLS.

SURVEYOR AND INSPECTOR OF NUISANCES.

The Council of the above-named District intend, on the 27th day of July, 1915, to proceed to the appointment of a Surveyor and Inspector of Nuisances for the District, at a salary of £140 per annum, payable quarterly.

The appointment will be subject to the approval of the Local Government Board, and the person appointed must possess the Certificate of some properly constituted examining authority in regard to his qualifications to act as Inspector of Nuisances. He will be required to devote the whole of his time to the duties, including those of Inspector under the Petroleum Acts, the Housing and Town Planning Act, &c.

As Surveyor he will have charge of the whole of the Council's undertakings, including the Waterworks, and will be required to take direct supervision of the workmen.

Applications, on foolscap paper, in Candidate's own handwriting, stating age, previous experience, with copies of not more than three recent testimonials, endorsed "Surveyor," should reach the undersigned not later than noon on the 27th day of July, 1915.

Canvassing any Member of the Council, either directly or indirectly, will disqualify an applicant.

D. C. DAVIES,
Clerk to the Council.

Town Hall,
Llandrindod Wells.
July 14, 1915. (2,632)

COUNTY OF DEVON.

MAIN ROADS AND BRIDGES DEPARTMENT.

Applications are invited for the appointment of Temporary Assistant Surveyor to act during the absence of a permanent official serving in His Majesty's Forces. Candidates must not be eligible for service in the Forces, and should be competent to take levels, make surveys, and have had experience in the control of men. Salary, £3 per week.

Applications, in candidate's own handwriting, accompanied by three testimonials, to reach the undersigned not later than 21st July, 1915.

W. P. ROBINSON, Assoc.M.Inst.C.E.,
County Surveyor (No. 2 Division).

22 Queen-street,
Exeter. (2,628)

FLUXPHALTE

There is no tar—or any by-product of tar as referred to in the recent Government Circular, contained in Fluxphalte. It is a pure liquid asphaltic bitumen—specially refined for spraying roads. : : :

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FINSBURY COURT, LONDON, E.C.

Telephone: 4704 City. Telegrams: "MEXPETRUM, AVE, LONDON"

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. JULY 23, 1915. No. 1,227.

Minutes of Proceedings.

Road Classification.

One of the most important papers submitted to the recent National Road Conference was that which dealt with the urgent question of the classification of roads, and we must congratulate Mr. Montagu Harris, the secretary to the County Councils Association, on the skill with which he treated a highly technical and complicated subject. It was, perhaps, only natural that he should have emphasised the county council point of view, but the arguments for more local control of second and third class roads were fairly stated, and his paper forms an excellent basis for a full discussion of the whole question. The arbitrary legal distinction between main roads and other roads, whatever may have been its merits in the past, is simply not applicable to modern conditions, and has practically no relation to the problem of classification as it at present exists. As Mr. Harris said in opening, the case for classification rests upon a threefold basis—convenience of communication, convenience of administration, and convenience of finance. As long ago as the Road Conference of 1909, before the creation of the Road Board, a resolution was passed in favour of the principle, and the Departmental Committee on Local Taxation, in dealing with the finance of highway administration, made definite recommendations on the subject. The latter committee wisely refrained from attempting to define a main or first-class road, but expressed the opinion that these should include not only existing main roads, but also those which afford communication between towns or access to railway stations, and those which bear a substantial portion of traffic which is not of a purely local character. It will be within the recollection of our readers that prior to the outbreak of war steps had been taken by the Road Board towards the accomplishment of classification, and probably some practical result would have been achieved by now had the traffic census not been interrupted by more pressing public demands. One good result of this delay is that more time is available for discussion and for the adjustment of the various interests involved.

Perhaps the most important question involved in the actual work of classification is as to the precise point at which the line between first and second class roads should be drawn. Neither the Departmental Committee nor the Road Board have given any definite guidance on this matter, but the former body have stated that on the whole they can see no reason why the total mileage of first-class roads in the administrative counties should be appreciably different from the present figure for main roads. This assumption provides for the allocation of about 28,000 miles of road to the first class, although, no doubt, in any new classification many of the present district roads would be placed in the first class, while many existing main roads would become second class. It must not be assumed that the traffic returns will be the sole or even the chief deciding factor in the classification. On the contrary, the first consideration would appear to be whether or not a road is a means of communication between places of importance, or whether a substantial portion of the traffic upon it is not of a purely local character. According to the suggestion of the Departmental Committee, the second class should include all roads in administrative counties which, though less important than first-class roads, may yet be regarded as serving more than merely local purposes. The criticism of Mr. Harris upon this suggestion is that it is too vague, but upon the basis of the estimated grant for roads of this class he deduces that it is contemplated to include about 30,800 miles, or 22 per cent of the total outside London and the county boroughs.

In regard to administration, Mr. Harris does not look for the establishment of a large central department corresponding to the Ministère des Ponts et Chaussées of France or Belgium, nor does he expect the establishment of any "national roads" in the sense that their maintenance and control will be withdrawn from the local authorities—and in this we agree with him. If this possibility be eliminated, two main questions are left—namely, what is to be the unit of area; and, this being determined, whether the control of all roads within the area is to be vested in a single authority or in separate authorities for the several classes of roads. Finally, as to finance, it may be said at once that this is a most important part of the whole problem, for it is more than probable that the Road Board, in making their classification, will be guided by the amount of the fund that the Government propose to distribute, and upon this amount the proportion of the Exchequer contribution to the upkeep of any class of roads

must ultimately depend. For a fuller consideration of these important matters we must refer our readers to the full extracts from Mr. Harris's very able paper which will be found in another column.

* * *

Trenches.

Mr. Reginald Brown's paper on "Trench Openings and Reinstatements," presented at the recent annual meeting of the Institution of Municipal and County Engineers, and reproduced on another page of this issue, dealt chiefly with the troubles caused by the opening of trenches in roads by the statutory companies who are given monopolies for supplying water, gas, electricity, or other public necessities. The powers given to these monopolist companies are accompanied by certain restrictions and responsibilities, and it was to the manner in which these restrictions worked and the responsibilities were met that the paper was largely directed. The trouble arises chiefly through the employment of workmen who have little or no experience with the laying of the surface materials, and whose principal work is that of pipe or cable laying rather than that of road making. Everyone is agreed that the road authorities should supervise all openings made in the public roadways. The statutory companies are required to notify the road authorities before making any openings, but although this notification is very generally given, the supervision which should follow the notification is by no means so generally exercised. Even where the road authority makes good the surface of the roadway by agreement with the company opening the trench, it is still necessary that the filling in of the trench by the companies' workmen should be carefully supervised by the road authority's officials.

Many towns have a schedule of prices at which the highway department restores all surfaces disturbed by other departments, public companies, or private contractors, and relieves them from any further charge for maintenance. To do this satisfactorily it is obviously necessary that the filling in must be carefully carried out and properly supervised. The difficulty of fixing this schedule was mentioned during the discussion of the paper, but it is a matter which can usually be got over satisfactorily by a meeting of the engineers of the various authorities. It is, of course, impracticable to have a fixed rate for all sizes of openings, as a small opening requires certain fixed expenses, such as carting tools and materials for at times considerable distances, which naturally makes the cost per yard very much higher than that of a long opening. One municipal engineer finds the following division of prices and areas work very satisfactorily in the case of the statutory companies for whom he carries out all repairs to road surfaces which they have disturbed: Under 5 yds. in area, between 5 yds. and 50 yds., and over 50 yds., the costs working out in the following proportions—1·40, 1·20 and 1·00. There are other openings besides those made by the statutory companies, such as the sewers and drains generally laid by the local authority or the builder; and as the trenches for these are generally very much deeper than those for gas, water or electricity, they are more difficult to reinstate, and frequently call for much greater care both during excavation and reinstatement. Deep excavations in narrow streets often lead to settlement in the adjoining buildings, while the greater depth of material in the trench takes a much longer time to consolidate, and calls for frequent repairs of the road surface.

The difficulty of putting back the soil in a trench with the same consistency that it had before it was excavated is much greater with some soils than others. A trench 5 ft. or 6 ft. deep, filled with dry clay, will go down for years after being filled in. The clay requires to be well puddled and rammed when filling. On the other hand, fine sand or gravel can be filled in almost as solidly as they were when excavated, and there is little danger of settlement afterwards. Chalk must be well watered before it can be consolidated. The weather has a great influence on many soils, for a loamy soil can be filled in much more closely when wet. Most engineers specify "the soil to be well rammed in layers not greater than 6 in. thick," but unless very carefully supervised this thickness is generally exceeded. "Well rammed" has a wide interpretation, and while one contractor will carry out this work carefully and well, another, if not well looked after, will throw the soil into the trench in layers of anything from 12 in. to 3 ft. thick, and get the navvies to use their feet instead of a rammer. An old foreman used to say: "You want two rammers to one filler," but it is no exaggeration to say that in most cases these numbers are reversed. Hand rammers in the hands of careful men are generally satisfactory, and "mechanical" rammers have not been much used for trenches in this country.

* * *

Rural Water Supplies.

At the provincial meeting of the Royal Sanitary Institute which was held at Yeovil on Wednesday of last week the subject of water supplies to rural and small urban areas was under discussion, being introduced by a paper by Dr. Savage, the county medical officer of health for Somerset. The dangers attendant upon the shallow well as a source of supply were duly emphasised by more than one speaker, but Dr. Savage boldly asserted that if such wells are properly lined so as to be impervious to water for a depth of at least 12 ft., and are covered in so as to avoid pollution from the top, the water should be quite fit for use, provided that the soil is reasonably suitable for filtration purposes. This may be so; but the fact remains that until local authorities are armed with adequate powers of control over the situation and construction of these wells, builders will continue to place them in such positions and to build them in such a way that serious liability to pollution will result. Until the financial difficulties which are inherent in the rural water supply problem are met in a more drastic manner, there is much to be said for Dr. Savage's suggestion that power should be given to local authorities to make by-laws, subject, of course, to the usual confirmation by the Local Government Board, dealing with the method of construction of surface wells and their position in regard to buildings and sanitary conveniences.

Dealing more generally with the whole question, Dr. Savage once more emphasised the crying need that exists for some form of central control over the sources of supply. It may be taken as an axiom that there is no valid reason (save financial exigency) why the water supply in a rural area should be either less in quantity or poorer in quality than that which is available for the town dweller. On the contrary, it is of special importance that the best possible supply should be given to farms where dairy operations are carried on, because serious epidemics of infectious disease may result from the infection of milk by contaminated water used, say, for the washing of vessels. In spite of this, however, the absence of central control and the apparent disinclination of neighbouring districts to co-operate are allowed to remain as serious obstacles in the way of providing as cheap and plentiful a supply as possible. As an example of the astonishing extravagance that may result from the present system, Dr. Savage cited the case of two small towns, both obtaining their water from the Mendip Hills, the springs being within 5 miles of each other. Nevertheless there were separate lines of pipes, separate reservoirs, and other works, together with double

expense of maintenance and administration. Clearly there is a crying need for co-operation in such cases on the ground of public economy, while in many others union of districts is the only way of securing a supply at all, and so is called for in the interests of public health. By sec. 279 of the Public Health Act, 1875, union of districts may be secured by either urban or rural authorities by means of a joint application to the Local Government Board for a Provisional Order; and Dr. Savage has performed a public service by once more calling attention to the necessity for such joint action in suitable cases.

* * *

Silsden Council and the Surveyorship.

The extraordinary circumstances in which we find ourselves placed appear to be giving a good deal of encouragement to certain members of local authorities whose habit it is to cry for economy at any price, including, it is needless to say, efficiency. These gentlemen are, in fact, exploiting the war on behalf of their favourite thesis, and in doing so they sometimes display an indifference to the interests of individuals which is characteristically unjust. Recently the Silsden, West Riding, Urban District have found it desirable to consider the question of dividing the offices of surveyor and inspector. The issue was apparently forced upon the council by the growth of the duties appertaining to both offices, and the difficulty of one man continuing to discharge the dual services. Mr. H. Longbottom has been surveyor and sanitary inspector for sixteen years, at the moderate salary of £115 per year, £60 of which was for the inspectorship and the remainder for the surveyorship. The work of surveyor is sufficiently onerous for any one man, including as it does the upkeep of 30 miles of roads, the management of the sewage disposal works, superintending the waterworks, and scavenging and cleaning the streets. The duties of inspector are, of course, very considerable, and there seems to be no doubt that the policy of dividing the offices is commendable, and, from the human point of view, necessary. In spite of this, the proposal was strongly resisted, and the ground of this opposition was the usual one of economy, or, as we prefer to style it, cheapness. If Mr. Longbottom was appointed sanitary inspector, it was asked, could they get a man "cheaper" as a surveyor than an inspector? It is satisfactory to find that the chairman of the Highways and Sanitary Committee was able successfully to resist all the petty reasoning of the opposition and induce the council to pass the proposition to divide the offices. It is to be hoped, further, that he will also succeed in obtaining a proper standard of remuneration for each. The policy of the council in the past as regards the surveyor's department, he states, has been of a too parsimonious character, and he added that the adoption of that policy "had led to at least one official, who had ever been ready to oblige the council, having more duties thrust upon him than he could satisfactorily discharge." If there is not a possibility of parsimonious treatment in the past being converted into a liberal policy in the future, it would at all events be a sign of grace if councillors would only seek to rise to the modest altitude of being just to their officers.

* * *

Sludge Pressing.

Whatever methods of sludge disposal may be adopted in the future, there is very little doubt that in a number of cases pressing will form an essential part of the process, especially where an attempt is made to convert the sludge into a marketable commodity as manure. For this reason any information that can be given with regard to improved methods of operation tending to economy in sludge pressing will continue to be of value, and in this connection the paper by Mr. J. T. Thompson, chemist and acting manager at the Knostrop sewage works, Leeds, which is printed on another page, will be welcomed by all of his fellow managers who have to press their sludge. The particulars given as to the comparative results of pressing sludge from septic and from settling tanks are very interesting, as definite figures are supplied as to the amount of lime required and the time occupied in each case. Then again the results of the prolonged experiments which were carried out to determine the most suitable quality of cloth to use and which means could be adopted to prolong the life of the cloth must be of great value. These results, and indeed the whole of the information given in the paper, are set out in an admirable manner, and the Association of Managers of Sewage Disposal Works is to be congratulated on having secured such a useful contribution to their volumes of "Proceedings."

It is interesting to note the opinion expressed by Mr. Thompson at the end of his paper to the effect that in time it will be possible to get rid of sewage sludge without causing any public nuisance, and at the same time, by the sale of by-products, to recover *at least* sufficient to pay the full cost of disposal. The use of the two words we have italicised suggests that the author had in mind the possibility of securing a profit from sludge disposal. We believe, however, that all sewage works managers will be quite content to be in a position to defray the cost of disposal alone, and we think it will be a long time before even this happy result can be attained universally.

* * *

Tramway Track Construction.

Mr. Bickerstaffe Holt, whose practical experience extends over many years as permanent way engineer of the Leeds tramways (and who recently received the further appointment of highways surveyor to that city), contributed some time ago to the *Tramway and Railway World* a series of illustrated articles descriptive of various types and details in tramway track construction and upkeep. These articles have been supplemented and revised, and now form the basis of a volume on "Tramway Track Construction and Maintenance."* It goes without saying that the contents of this book are eminently practical and descriptive of the science and technique of tramway construction and maintenance as practised at Leeds under the author's control, or as may have come under his observation elsewhere. The illustrations are numerous and generally excellent, many being of a unique nature and from photographs specially taken to elucidate and emphasise the author's exposition of particular points of practice.

Tramways are being subjected to a good deal of adverse criticism, not always emanating from an unbiassed source. It cannot, however, be gainsaid that some of this criticism has been warranted by the dilapidated condition into which some tracks have been allowed to fall. The information and data in this book will do much to show to tramway authorities and their advisers wherein mistakes and omissions in construction and upkeep are conducive to disrepair, and make clear the better methods to ensure durability, which should be the aim in future. The chapters under the head of "Track Paving" are particularly lucid and practical, and the illustrations of various types of paving materials in different stages of wear are both interesting and instructive. To all who are engaged upon or interested in tramways, and even to those engaged in road engineering, we can strongly commend this volume as an excellent compilation and a valuable book of reference.

* By R. Bickerstaffe Holt, M.I.M.E., &c. Price 10s. 6d. nett. London: *Tramway and Railway World*.

Seven Years' Experience with a Large Sludge-pressing Plant.*

By JOHN T. THOMPSON, Chemist and Acting Manager, Knostrop Sewage Works, Leeds.

In Leeds we often get inquiries for information about the practical details of the maintenance and working of our pressing plant. This is probably due to the fact that, although sludge pressing had been successfully accomplished at several places before Leeds began in 1907, we did some pioneer work with large 54-in. presses. Therefore, when the request came from your association for a paper of general interest to sewage works managers, Mr. Hart, the sewerage engineer, very readily consented to allow me to bring before you a concise account of the knowledge gained at Leeds from observations and experiments on this method of preliminary sludge treatment.

The author also wishes to express his thanks to Alderman T. Oldroyd for granting him permission to publish this paper.

Those who have to deal with the sewage problem will freely admit that the chief difficulty centres around sludge treatment. Considerable attention is now being concentrated on this question, and a variety of processes are being tested on a fairly large scale. The initial difficulty of concentrating 90 per cent sludge down to 60-70 per cent sludge, so that it may be handled conveniently, has been met by land treatment, septic fermentation, cracking with acid, &c.; but pressing is the only method which will be considered in detail here.

The dry-weather flow of sewage in Leeds is about 17,500,000 gallons per day, about 22 per cent of which is derived from trade sources, chiefly from scouring, dyeing, leather and soap industries. The crude sewage is always slightly alkaline to methyl orange.

PRELIMINARY EXPERIMENTS.

The old system of lagooning has never been adequate to deal with the large volume of sludge produced from Leeds sewage; therefore, in order to obtain reliable data about sludge pressing, a unit of pressing plant was put down. The press was hand-closed, and contained forty-five cells formed with plates 32 in. square. It produced from 12 cwts. to 13 cwts. of cake per filling. The press was filled from a spherical ram by means of compressed air at 100 lb. per square inch. The sludge entering the storage tank was screened through a steel plate perforated with inch holes to retain match stalks, hair, &c., which choked the feed pipe in the press, and caused the plates to break if not removed by screening.

From February to August, 1907, settled sludge, produced without precipitants from the different tanks, was pressed with various doses of lime. In order to obtain good cake the time of pressing varied from three hours, when no lime was used, to fifty minutes, when 1 per cent by weight of quicklime was added to the sludge.

Further experiments were tried with septic sludge. It was found that septic sludge from a tank which had been working four months and still contained undigested fibre only yielded very indifferent cake after pressing without lime for 3·5 hours, and even with 1 per cent lime the cake produced in this period was often very soft in the middle. With older septic sludge, which contained very little fibrous material, no satisfactory cake could be obtained after repeated trials with 1 per cent lime; but with 3 per cent lime good cake was consistently turned out in about 1½ hours. When pressing septic sludge it was extremely difficult to remove the cake completely from the filter cloth; therefore the hard scraping necessary for this purpose, and the rotting action of the excess of lime in the press effluent, would materially increase the cost of pressing sludge.

The table below gives the average results for septic sludge pressed under the best conditions, and also the average result of a large number of pressings of settled sludge, free from precipitants.

These figures show a marked increase of mineral matter, and corresponding decrease of volatile matter in the septic sludge cake.

The conclusion drawn from our experience with this experimental press was that it was easy to obtain good cake containing about 60 per cent water from unsepticised sludge in about one hour with the addition of 1 per cent lime. This proportion of lime has since been giving good results when applied to the large new plant, and we had no difficulty in getting good cake from the start. It was found that if the press effluent is just alkaline to phenol phthalein, a good cake can usually be obtained in fifty-five minutes, but if the effluent gives no colour reaction it may take one and a-half to two hours to get the same result. This simple test enables the press-house foreman to check the process readily.

Sludge from—	Water in sludge.	Gallons of sludge pressed.	Lime added.	Cake produced.	Time pressing.	Water in cake.	Volatile matter.	Mineral residue.
	Per cent		Per cent	lb.	hours.	Per cent	Per cent	Per cent
Septic tank	92·2	471	3	1396	1·25	58·9	11·3	29·8
Settling tank	92·1	513	1	1204	0·8	59·0	18·3	22·7

DESCRIPTION OF THE PRESSING PROCESS AND PLANT.

The screened sewage, after passing through grit tanks, is precipitated with lime varying in quantity from 1 to 10 parts per 100,000 during the twenty-four hours. The precipitated sludge from the tanks passes into a well. Two Tangye pumps are used to raise the sludge into three cylindrical sludge settling tanks, each of 320 tons capacity; a pipe connects the common suction of these pumps with the milk of lime supply, which is so controlled that the volume of sludge raised by each stroke of the pump receives its dose of lime, and becomes thoroughly mixed with it. The milk of lime for pressing is prepared in vats holding 13 tons of water, and fitted with Gabbut mixers; 3 tons of quicklime from the railway truck are weighed off in small bogies, and discharged direct into the vats, where it is hydrated. The nodules of the unburnt limestone continually moving about the vat help to break up the unslacked lumps of lime, and thus assist the hydration. It is usual for the limeman to start preparing a vat of lime about six hours. When it is required it is hot and well hydrated; then water is passed through the vat so as to have a self-cleansing velocity in the shoots leading to the sludge pumps.

Thus, 3 tons of lime are discharged into one sludge tank, holding 320 tons, while it is being filled. This method of making and distributing the milk of lime gives very satisfactory results. The lime mixers are electrically driven, and require about 4-h.p. each. The limed sludge, containing about 90 per cent water, is allowed to settle in the tanks as long as possible, and the supernatant water decanted off in layers by means of a shutter device and valve.

Usually the sludge gets from twelve to eighteen hours' settlement before it is pressed. The relation between the volume of sludge and that of the supernatant water run off after settlement is given in the table on opposite page.

The sludge settlement tanks are connected with two pairs of automatic sludge rams, each 6 ft. diameter by 12 ft. deep, with dished ends; each pair of rams feeds four presses. When one ram of a pair is full a large float tips over the slide valve gear and connects the other empty ram with the inlet side of the air compressor; then, partly by suction and partly

* Paper read at the recent annual summer conference of the Association of Managers of Sewage Disposal Works at Leeds.

by gravitation, this ram fills with sludge until the gear is reversed again, and so on until the presses are full. The compressed air is maintained at 100 lb. pressure by three air compressors, two of which are ample to keep the presses going. As the air left in

Number of tanks of sludge pressed for year 1913-14.	Average time of settlement of mixed sludge.	Average percentage of supernatent water run off.
37	6 hours	6 per cent
161	12 ,,	7·8 ,,
63	20 ,,	11·8 ,,
24	36 ,,	12·7 ,,
6	42 ,,	13·7 ,,
4	56 ,,	15·7 ,,

the empty rams is not discharged into the atmosphere but returns to the compressors, a considerable economy in the capacity of the air compressors required is obtained. There are eight presses, each containing sixty-four cells, 52 in. square by 1½ in. deep; thus each press can produce 4½ tons of cake per filling. The presses are hand-closed; the final squeeze is applied by means of hydraulic thrust blocks. When the presses were installed in 1907 they were the largest ones in use in this country; in fact, the plates are as heavy (6 cwts.) as two men can conveniently handle in closing and opening the press.

The cake drops from the presses into 50 cub. ft. side tip bogies hauled by a small locomotive.

Eight labourers are employed manipulating and clothing the presses, and four others in marshalling the bogies on the ground floor. In a normal working week of fifty-three hours they turn out about 800 tons of cake. At first a night shift was tried, but, owing chiefly to the difficulty of disposing of the cake in the dark, it was abandoned.

During the year ending March 31, 1914, 23,780 tons of cake were tipped on low-lying land on the Thorpe Stapleton estate, and 12,382 tons were used for manurial purposes by farmers who obtain it free on rail at the Knostrop works.

The pressing plant, including presses, staging, air compressors, sludge rams, and storage tanks, was erected in an existing shed at a cost of about £6,000, excluding unskilled labour supplied by the corporation.

IMPROVEMENTS TO PLANT AND PROCESS.

The new pressing plant was first put into operation in August, 1908, and as a result of careful experimental work with the small press we had no difficulty in obtaining good cake; but experience has led us to make several changes which may be discussed separately.

PRESS PLATES.

After a few months' work the press plates began to bulge and crack to a serious extent without any stoppage occurring between the plates, which would put pressure on one side of a plate only. The makers maintained that the sludge was not sufficiently screened; therefore an extra set of ¾-in. screens were put in between the grit pits and the precipitation tanks, but still the breakage continued until about sixty plates were affected. Finally, it was concluded that these large 52-in. plates were insufficiently supported around their centres by the original four bosses situated on the diagonals of the plates, 16½ in. from the centre; hence the plates were bored, and four more bosses fitted on the rectangular axes of the plates, 8¾ in. from the centre. This completely solved the problem, for, although many cracked plates were fitted with bosses, not a single plate has been broken since.

PRESS CLOTHS.

The first consignments of these cost 5s. to 6s. per "double" cloth; they were securely sown together round the central hole, and had three brass eyelets along the top edge which attached the cloth to hooks on top of the plate. It was clearly necessary to reduce this expense, and the sewerage engineer, Mr. Hart, decided to test a large variety of cloths from different makers to determine which was the most economical cloth to use.

These tests were carried on from August, 1908, until March, 1911, and for purposes of comparison all the results were expressed as—

$$\text{Comparative cost of one pressing} = \frac{\text{Cost of 65 cloths + cost of clothing (10s.)}}{\text{Average number of pressings.}}$$

Or for bales

$$\frac{\text{Cost of 200 yds. of cloth + cost of clothing and cutting (18s.)}}{\text{Average number of pressings.}}$$

The number of cloths used for a test was always sufficient for two presses, and often there was sufficient to clothe four or six presses. The average figures given below represent a large number of tests extending over nearly three years:—

Weight of cloth per square yard.	Fibre.	Weaving.	Average cost per "double cloth."	Comparative cost of one pressing.
			s. d.	s. d.
20 ounces	Jute	—	2 6	2 7¼
24 ounces	Jute	Twill; 2-ply untwisted warp, single ply weft	2 9	2 8¾
27 ounces	Jute	Twill; 3-ply medium twist warp, single-ply weft	2 9½	2 0
27 ounces	Jute	Herring bone, single-ply weft and warp	3 6	2 5
30 ounces	Jute	Herring bone, single-ply weft and warp	3 9	2 5
30 ounces	Jute	Twill; 3-ply medium twist warp and weft	3 4	1 9
30 ounces	Jute	Twill; 3-ply medium twist warp and weft	per yard 9d.	1 4

"Ramie" sacking was tested, but was no use; on the other hand, hemp sacking gave very similar results to jute when woven in the same way, though the price per yard of hemp cloth is considerably higher.

Since these tests, jute twilled sacking, 54 in. wide, three-ply medium twist, both warp and weft, and about 50 per cent of each, weighing 30 oz. per square yard, has always been used; lighter sacking soon tears with the heavy drag of the cakes (which weigh 1½ cwts. each) when the press is opened.

The made-up "double cloth" was unsatisfactory, not only because of the extra cost of sewing and eyeletting, but it was difficult to fit on the plate, and was liable to tear immediately around the eyelet holes through unequal strain. Therefore, since 1909 the cloth has been bought in 100-yd. bales. It is cut up in 9-ft. 1-in. lengths, folded over the top of the plate and secured in position by a malleable-iron bayonet-joint clip, made to our own pattern, fitting round the central hole. It will be seen that this improvement reduces the comparative cost of one pressing from 1s. 9d. to 1s. 4d.

OILED PRESS CLOTHS.

Cloths always tear along the top of the cell, and about 1 ft. down each side first, and thus have to be replaced while the main bulk of the cloth is still in good condition. Probably this action is chiefly mechanical, due to the nip of the plates, and the weight of the cake which hangs on one of the cloths when the cell is open, but is intensified by the rotting action of the free lime, and possibly by bacterial action.

During 1911 and 1912 the author carried out experiments with a view to increasing the life of the cloth. In the first place the 100-yd. bales were shrunk in water before being cut up; they decreased in length from 3 yds. to 4 yds., but there was no improvement. Other bales were shrunk in a 2·3 per cent solution of copper sulphate with the object of checking any bacterial disintegration of the fibre, but this treatment actually shortened the life of the cloths. Other bales were bark-tanned with fairly good results. But the best result was obtained by oiling an 8-in. strip round the outside of each cloth, round the centre hole, and where the bosses meet. For the experiment "Golden Bloomless" mineral oil, at 1s. 2d. per gallon, was used. Two or more 100-yd. bales of cloth from the same consignment were treated in each case.

The figures given on next page indicate that considerable saving could be effected by oiling cloths.

Apparently the effect of the oil is not to strengthen the fibre, but to make it more elastic, so that it is able to stretch more easily as the cake forms between the two surfaces of cloth which are in contact in the empty press. Further trials were conducted to find a cheap viscous oil which could be brushed on to the cloths, and which would not wash off to any

extent during the life of the cloth. In the end it was found that "black oil"—a crude petroleum residue with a viscosity of about 250 at 140 deg. Fahr., costing about 6d. per gallon—gave the most satisfactory results; 1 gallon of oil is sufficient to oil five cloths. This method of treating the press cloths has

—	Untreated cloth.	Water-shrunk cloth.	Shrunk with copper sulphate.	Bark tanned cloth.	Oiled cloth.
Average number of pressings per cloth ...	114	106	92	127	134
Comparative cost per pressing including cost of treatment	s. d. 1 7	s. d. 1 8	s. d. 2 0	s. d. 1 9½	s. d. 1 5

been in continuous use since July, 1913. A recent test with forty-four plain and forty-four oiled cloths showed that the average life of the oiled cloths was 200 pressings as against 156 for the plain cloths.

Some idea of the economy obtained by the use of oiled press cloths can be got by comparing the cost of pressing in the last complete year (1912-13), when plain cloths were used, and the first complete year (1914-15) with oiled cloths:—

Year ending	Cloth.	Price per yard.	Total yards of cloth used.	Total weight of cake produced in tons.	Annual cost of sludge pressing.	Cost per ton of cake.
		d.			£	s. d.
Mar. 31,'13	Plain	10·62	18,200	35,297	3,261	1 10
Mar. 31,'15	Oiled	13·66	9,806	37,787	3,181	1 8·2

The annual cost of sludge pressing, including wages, lime, press cloths and power, has slightly decreased in spite of the fact that the cost of labour has increased ¼d. per hour, lime 1s. per ton, and press cloth 2d. per yard; in other words, if oil had not been used during 1914-15, the author estimates the cost of sludge pressing would have been £3,570 instead of £3,181—*i.e.*, the oiling process has saved over £300 per year. Of course, the increase of 2,490 tons in the output of cake has nothing to do with the treatment of press cloths, but is due to the more efficient management of the plant.

DRAINAGE.

The effluent troughs of each press discharged into a 4-in. pipe connected with a 6-in. main drain designed to take the effluent from all the eight presses. Incrustation on the interior of the pipes and obstruction from bits of cake soon caused serious flooding of the troughs, and often the ground floor of the house was covered with water. This difficulty was ultimately overcome by draining the effluent from half the presses into a disused culvert which was found conveniently near. In putting down new plant it is evidently essential to provide drains of ample capacity, so arranged that they can be readily cleaned out in sections.

THRUST BLOCKS.

The hydraulic thrust blocks used to get the final squeeze of ¾ ton per square inch on the presses were suspended on a pair of steel straps attached to balance weights. These straps frequently broke, so a cradle sliding to and fro on two horizontal bars was designed to carry the block; later a special hydraulic closing and opening gear was designed for one press, which dispenses with the heavy manual labour of closing the press in a very satisfactory manner. This device will be embodied in the headstock of the new presses.

MOVEMENT OF PRESSES.

When the presses were installed they were not attached to the floor in any way; it was soon found that the pressing operations caused the feet of the presses to creep slightly and get out of parallel. The movement never fractured the inlet pipes, but the side bars bent and the joints between the plates along one side were continually blowing out owing to the unequal pressure; also the buttress threads on the locking nuts stripped off. It was found that by anchoring the feet at the inlet end of the presses by means of strong iron straps bolted to the girders of the staging this trouble was reduced to a minimum.

Evidently, presses of this large size should be so designed that their inlet headstocks may be rigidly attached to the floor, while the other end is free to move slightly to and fro in guides. To protect the workmen from "blow-outs" galvanised-iron hoods, moved by means of pulleys and balance weights, are fitted over the presses.

There is still another important improvement which can be made. At present there are no valves between the automatic rams and the valve box leading to the inlet pipes of the presses. Consequently, when an accumulation of coarse solids puts the valve box out of action, it is impossible to clear it without first emptying the sludge out of the ram through the valve box, and sometimes, owing to the cross connections, it is necessary to empty the pair of rams. If a valve were placed on the outlet of the rams they could be shut off, and any obstruction removed from the valve box in a few minutes instead of after an hour or more of filthy work in the sludge, as at present.

COMPOSITION OF PRESSED CAKE.

The composition of the cake varies very little throughout the whole year; the average results for the year ending March 31, 1914, are:—

	Per cent
Water	60·1
Volatile matter—	
Containing nitrogen 0·59 per cent Total grease 6·3 per cent	16·7
Mineral residue—	
Containing calcium phosphate 0·94 per cent	23·2
	100·0

MANURIAL VALUE OF SLUDGE CAKE.

Both the nitrogen and phosphate in cake chiefly exist as compounds insoluble in water; hence it is a slow-acting manure, and its effect, which is both chemical and physical, is spread over a number of years. It is extremely difficult to ascertain the value of this class of manure unless trials are repeated carefully; but the general experience of farmers who have used it for some years may be indicated.

In the first place sewage manure should invariably be applied in autumn or early winter to give it time to weather. It should not be placed direct in the rows when turnips, mangolds, or potatoes are sown, and should only be used for these crops by ploughing it into the land in autumn, and then using a smaller dressing of farmyard manure in the rows in Spring. Owing to the quantity of fibre and detritus in this manure its persistent use has a beneficial effect in making heavy clay land more friable, and at the same time, when used on very light land, it tends to absorb the heat, and by retaining the moisture prevents, to some extent, the bad effects of a hot, dry summer. It is a good autumn dressing for grass land. Good results have also been obtained by putting 15-20 tons per acre as an autumn dressing on land which will be sown with barley and seeds later. The barley is not much improved, but a fine crop of seeds is produced the following year.

Market gardeners find that it is no use for "short" crops, but a dressing of 50 tons per acre gives good results with cauliflower, broccoli, brussels sprouts, &c., which are not cut until winter or the following Spring. Some buyers, who have the convenience, prefer to store the manure in summer to allow it to heat up and decompose before they use it.

Rhubarb is largely grown in this district. After the plants have been forced they are usually rested for about a year, and then planted out for two years. A dressing of about 60 tons per acre has been found to give satisfaction for this crop, as it has two years to act.

The remainder of the cake not used for agriculture is tipped on low-lying, water-logged land near the river. The thickness of the deposit amounts to 12 ft. in places. It is found that in the course of about two years cake generates a considerable amount of heat, and settles down to about two-thirds of its original bulk—*i.e.*, if it is desired to raise the level of a plot of land 6 ft., cake must be tipped to a depth of at least 9 ft. over the area. When the area has become consolidated it is proposed to fill in the irregularities with soil and crop the land. Already potatoes and cabbages have been grown on a small area of this recovered land successfully.

COST OF PRESSING AND DISPOSAL OF CAKE.

During the year ending March 31, 1915, 37,787 tons of cake have been produced at a cost of £3,181, in-

cluding wages, lime, cloths, oil, power, but excluding interest and sinking fund. In addition, the nett cost of the disposal of the cake was £1,373.

These statistics show that the sludge disposal at Leeds is being conducted economically. The cost of 1s. 8·2d. per ton of 60 per cent cake for pressing, and 8·7d. per ton for disposal is very low, and compares very favourably, for instance, with Glasgow, where a somewhat larger amount of sludge is dealt with at Dalmarnock works by the same process. For 1913-14 the Glasgow costs were: Pressing of cake, 2s. 2·7d.; disposal of cake, 11·7d. per ton.

One always finds considerable difficulty in harmonising the cost statistics of sludge disposal published by various authorities, for they often omit some essential factor in the problem. It would be a great advantage if some standard expression of costs could be adopted by all.

Cost per 1,000,000 gallons of sewage treated and cost per ton of dry sewage solids are both in use, but on the former basis the strength of sewage is not allowed for; therefore the latter standard for cost of sludge disposal processes is preferable, in the author's opinion, for it enables all processes to be compared, whether materials are added to aid the process or enrich the product or not. At Leeds, in a normal week, 800 tons of 60 per cent cake are produced, and in the process an average of 37 tons of lime are added for precipitation and pressing combined—

i.e., dry sewage solids per week = 320 − 37 = 283 tons.
dry sewage solids in cake = 35·3 per cent.
1914-15 cost of pressing = 1s .8·2d. per ton of 60 per cent cake
= 4s. 9·1d. per ton dry sewage solids.

RECOVERY OF BY-PRODUCTS.

Although there is a considerable volume of wool and piece scouring effluent in Leeds sewage, the grease is efficiently recovered by the manufacturers, and the sludge cake only contains about 6 per cent total grease (ether extract). Up to the present one has little evidence that this amount can be economically recovered.

Good progress has recently been made in the drying of sludge, which is an important step toward the recovery of by-products, although Glasgow experience shows that in that district it is easier to sell wet cake than the dry product as a manure.

The Dublin drier (J.S.C.I., May 31, 1915, p. 517) and the B.T.W. drier working at Tadcaster are two different types of machines which are apparently giving good results.

Some time ago an experimental plant for the destructive distillation of dry cake was tested at Knostrop, but the quantity of ammonia and oil recovered was not satisfactory. This was largely due to defects in the plant itself. Further research in this direction has been held up by the war. The most impressive fact about the distillation process was the large volume of combustible gas evolved. It is beyond the scope of this paper to discuss further the new scientific methods now used for the final disposal of sludge, but the progress already made in this direction shows that in time it will be possible, by artificial processes, to get rid of the sludge without causing any public nuisance, and make sufficient by the sale of by-products at least to pay the full cost of disposal.

Public Slaughter-houses.—Mr. H. V. Lynam, surveyor to the Alsager Urban District Council, writes: "I should be very grateful if surveyors who have in their district a public slaughter-house would be good enough to favour me with particulars as to cost of such buildings complete, annual expenditure upon upkeep, income derived therefrom, and with any other useful information. I only seek particulars from those districts having a population of from 3,000 to 5,000."

Tees-side Plumbers' Wages.—The operative plumbers recently gave their employers notice for an advance in wages of 1d. per hour—10d. to 11d. According to agreements the question came before the Conciliation Board, who were unable to come to a decision. At the unanimous request of the board, Mr. S. E. Burgess, borough surveyor of Middlesbrough, undertook to act as arbitrator. He has now given his decision to the effect that the wages remain unchanged. Mr. Burgess pointed out that the request was for an advance of wages, not a war bonus, and he had considered the question on those lines. The decision affects Middlesbrough, Stockton, and the Hartlepools.

CORRESPONDENCE.

Ἐκάστῳ γὰρ ταῦτ' ὀρθά
(*One man does not see everything.*)
EURIPIDES.

ROAD TARS.

To the Editor of THE SURVEYOR.

SIR, In "Minutes of Proceedings" (always to me most interesting) of last Friday's issue it is stated that Mr. Greenshields "finds ordinary boiled gas-tar gave him satisfactory results."

It would greatly help many who are engaged in the preparation of tar-macadam if surveyors would throw some light on their methods of producing a binding material from crude tar. Mr. Greenshields states in his paper on Bedford that "all tar is carefully boiled before use."

Does this mean that the temperature of the tar is so "carefully" adjusted that the danger of boiling over or "bumping" is avoided, or is it that the tar is "freed" from the water and lighter oils and brought to the required consistency? If the latter is that to which "carefully" applies, how does Mr. Greenshields control the vapours—dangerous from fire as well as noxious?—Yours, &c.,

JOHN HUTCHINSON.

London.
July 17, 1915.

ESSEX MAIN ROADS.

COUNTY SURVEYOR AND WEIGHTS OF VEHICLES.

The county surveyor of Essex, Mr. P. J. Sheldon, in his annual report, states that main roads, exclusive of those under contract with urban authorities, cost for upkeep and improvements £115,472. One of the principal items was tar-painting, 3,511,528 super. yds. having been treated at an average cost of $1\frac{3}{4}$d. per yard.

The year's expenditure was considerably less than the estimate, owing to the difficulty, through the war, of obtaining granite, but the result had been that the general condition of main roads had distinctly lowered, and the abnormal weather and the exceptionally heavy traffic which had arisen owing to the war would, it was feared, seriously affect the roads for some time to come.

No ordinary road crusts could stand the strain imposed by these vehicles during such a winter as the past one, and the sooner this was recognised the better, and more stringent regulations made as to the weights that might traverse the highways.

Owing to the war it had been possible to spend only £108,810 of the anticipated amount of £173,920 under the scheme of resurfacing to cost £576,890 in five years.

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—The rapid increase of sand wastes around our coasts is indeed a serious one, and Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

Air-raids and Public Lights.—The Commissioner of Police has issued a circular letter stating, on the authority of the Admiralty who are responsible for the protection of London against aerial attack—that it is undesirable to extinguish street lighting when warning is received of an impending air-raid. It is pointed out that such a course would be fraught with serious consequences, and might bring about more casualties than would be caused by the enemy aircraft.

Heavy Traffic on Highways.—At the annual conference of the Urban District Councils Association, which was held at Westminster on Friday last, Mr. Frederick W. Wood, clerk and solicitor to the Surbiton Urban District Council, moved: "That this conference of urban district councils of England and Wales urges upon the President of the Local Government Board the necessity of the law and regulations relating to the construction and use of road locomotives and heavy motor cars being amended in accordance with the proposals previously submitted to the board on behalf of the Urban District Councils Association; also that, with a view to preventing the use by traffic of this character of roads which are unsuitable for the purpose, this conference again records its opinion that every urban district council should have the power, as regards their own district, to prescribe the route or routes to be taken by such vehicles, subject to appeal to the Local Government Board." The motion was agreed to.

Trench Openings and Reinstatements.*

By REGINALD BROWN, M.INST.C.E., M.I.MECH.E., F.S.I., Surveyor and Engineer to the Southall-Norwood Urban District Council.

If highway surveyors were given to using strong language—as some of the general public are—there is, perhaps, nothing which would make it easier to do so than "meditation on the sins of omission and commission" by statutory companies and others in dealing with trench openings and reinstatements. . . . Water companies, tramway companies, telephone companies, electric light and power companies, gas companies all come in for their share of condemnation, and one must not forget also the rights of individuals to break up the pavements.

The object of this paper is not so much to bring before the members of the institution that which is so apparent to all, but rather to suggest, if possible, some remedy or remedies for amelioration of the disease. Before, however, one can apply a cure, it is necessary to know what gives rise to the disease, and also its symptoms, and suggest, if one can, a remedial cure of such skin eruptions as applied to roads, or what may be termed "Highway Dermatology."

THE CAUSE OF THE DISEASE.

The Legislature has given privileges to various monopoly companies to open the highways for particular purposes. A company goes to Parliament for an authorising or special Act to carry out the work of supplying the public with certain necessities, and in doing so provisions are included in the special Act which permits the company to open trenches, but subjects them to restrictions and responsibilities. To avoid constant repetition in special Acts certain general Acts have been passed, and the provisions for "opening" highways contained therein are, as a general rule, embodied in the company's special Act. Thus we have the Gasworks Clauses Act, 1847, and its amendments governing gas companies; the Waterworks Clauses Act, 1845, controlling water companies, the Electric Lighting Acts, the electric light companies; the Tramways Act, the tramway companies; the Telegraph Acts—the Post Office and various Acts giving rights, under restriction, to the general public. Besides all these, special Acts are in force as to hydraulic power companies and others. The "cause of the disease" is therefore due to "certain rights" exercisable by a person or persons by the authority of "Parliament," and it is as well to bear in mind which persons have those rights and which have not, and the conditions under which such rights are to be exercised, and for this purpose one must look at the Acts previously mentioned, and also the special Acts of the company operating in any particular district.

Generally speaking, statutory companies, with which this paper deals, have power to open roads subject to giving three days' notice to the local authority, except in the case of emergency, when the notice may be given within a few hours after making the opening, the object being to give an opportunity for supervision not only in the "breaking up," but also in the reinstatement. Although this supervision may be given, it does not relieve the statutory company from their obligation to maintain the surface of the trench for a period of six months.

SYMPTOMS OF THE DISEASE.

Every municipal engineer is only too well aware of the frequent openings that take place in the highways under his control. He is also well aware of the great difficulty experienced in reinstating a highway after it has once been broken up, and this is all the more apparent in those roads which are surfaced with improved materials.

There is an old saying that "Three moves is as good as a fire," and the saying may be equally applied to roads—a fire requires reconstruction, a tearing up of the highways also requires reconstruction in many cases, to minimise the damage done by the "moves." The moves should be carefully carried out, and to minimise the damage done by "trenches" the trenches should be carefully opened, and just as carefully filled in, so as to put off reconstruction as long as possible. A good many illustrations of actual "tearing up" of roads could be given, but the author only desires to give one typical instance, leaving the members to fill in the remainder from their own knowledge. The plan given shows a road of a nature frequently met with in the developing suburbs of a large town. The surface of the carriageway is coated with Kentish pit-flints, and the paths paved with artificial stone paving, the kerb and channels being of granite on concrete. The openings shown are those made for gas, water and drains since the road was originally constructed, and gives a fair idea how such a road can be cut about, leaving very little of its original surface intact. In a road paved with wood, granite setts or tarmacadam such a number of openings would be very serious, as it would necessitate a complete reconstruction. In a granite macadamised road, however, the "corduroy" appearance of the surface would soon be obliterated, as this type of road is more frequently under general repair. In flint or gravel roads—such material being used for light traffic only—the "corduroy" is very marked.

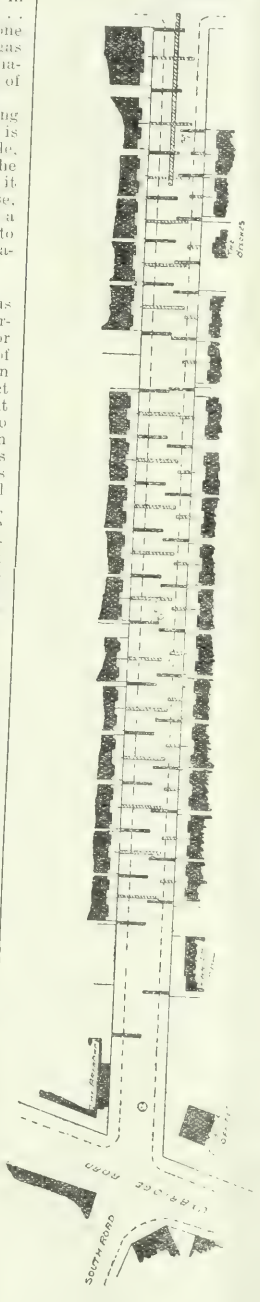

Fig. 1.

The symptoms of the disease may therefore be summed up in the word "corduroy."

REMEDIAL CURES FOR THE DISEASE.

Having briefly discussed the "cause and symptoms" of the disease, is it possible to suggest a remedial cure? In dealing with this aspect of the question, one must not only consider roads "repairable by the inhabitants at large," but also the so-called "private streets"—private inasmuch as they are maintainable by private individuals, but public, the public having rights of user. In the latter case the companies and private individuals tear up the roads at their own sweet will, and are subject to no supervision from an outside authority, with the result that in many instances the "filling in" is not properly consolidated, neither is the material replaced in its proper position, the softer material being frequently mixed with the original

* Paper presented at the recent annual meeting of the Institution of Municipal and County Engineers.

surface material, the result being sinkages and greater [illegible] when the Private Street Works Clauses are in operation. As, obviously, [illegible] is better than cure, openings in the highways should be under the control of the local authority, and companies and others should be under similar restrictions and obligations in "private" roads as they are in "public" roads; but as this would require an Act of Parliament, we must, for the present, depend upon the watchfulness of the owners of the roads, without whose permission the roads cannot be opened. In public roads, however, the local authority has control even although it may be a limited one. So far as openings for private houses are concerned, a large number of authorities insist upon these as well as the maintenance being done by their own staff; but with statutory companies the roads are opened and filled in by their own men, and in some cases they carry on the maintenance for the stipulated period, while in others they enter into arrangement with the local authority to do the work of maintaining.

From an administrative point of view it would probably be best that no one except the local authority should break up the highways; but this idea is unworkable in general practice, and the author is satisfied that with statutory companies such an arrangement is not at all necessary. Let surveyors put forward some plan whereby the difficulties arising from trench openings can be obviated or minimised, then the author feels certain that they would meet with due consideration from the parties intimately concerned. First, as to the present methods:—

(1) A company may open, fill in, and maintain for a period of six months;

(2) A company may open and fill in, and the local authority may maintain by arrangement with the company.

In both cases notice "to open" is given, and the surveyor may or may not supervise, according to the extent of his district and other duties which prevent him doing so, and if the supervision is not given during the opening and filling in, then satisfactory maintenance becomes more or less difficult, according to the care and skill of the company's workmen. In urban districts it might be comparatively easy for efficient supervision to be exercised, but in rural districts such supervision would be out of the question; even in some urban districts it would require the constant services of a special officer.

Probably a simple arrangement would be for those who open the roads to pay the road authority for the cost of supervision—as in the case of tramway companies—and if this was done the companies might be relieved from maintenance. The supervision could be exercised by an intelligent working man used to road construction, so that it would not be a costly procedure. Again, some agreed-upon details as to how such opening and filling in should be carried out would be much more satisfactory both to surveyors and the companies concerned, and this will depend somewhat upon the nature of the road and the character of the traffic on same. The author suggests the following for the consideration of the members of the institution:—

Before any person opens a road he should not only be required to give the statutory notice, but at the same time should deposit a plan showing the exact position of the trench, with dimensions and the date on which the work is to be commenced and will be completed, and also stating the purpose for which the opening is needed. These notices should be entered up in a record book for easy reference at any time, and the date noted on which the maintenance terminates, so that if any repairs are necessary within that period the companies can be notified. The latter would be necessary if the companies were relieved of the maintenance, as previously suggested.

All openings to be excavated of the minimum width required for the particular purpose, and, if necessary, the sides timbered. All subsoil material to be kept separate from the surface material.

The "filling in" is most important, as upon it depends the future maintenance; one often sees the sides of a trench badly filled in breaking away from the adjoining crust. The object to be aimed at is to get the earth back into the trench again in as nearly as possible the same space as it occupied before disturbance, and the nearer this can be done the better; the only way to do this is to thoroughly "pun" it in thin layers. The method of "punning" at the present day is not, however, satisfactory, as it depends upon the "human equation." Two men with exactly the same weight of rammer will give very different results, and it is therefore advisable for companies to be provided with mechanical rammers, and [illegible] for the ramming to take place in layers not exceeding 6 in. in thickness. The method of filling in near the surface will depend upon the nature of the road covering. Thus, in a flint or granite macadam road there should be a layer of broken hardcore, from 4 in. to 9 in. in thickness, solidly punned, and the surface coating applied at least 3 in. thick; this surface coating should not simply be applied within the limits of the trench itself, but should extend over the sides, so as to become incorporated with the adjoining surface, which has previously been loosened, the whole afterwards being rolled.

In paved roads a little different procedure might be thought necessary, but the author does not think so if the consolidation is carried out in the manner suggested; the concrete bed and paving could be replaced immediately, but the same precautions should be taken as to carrying both beyond the limits of the trench itself.

The author therefore suggests that remedial cures or preventive medicine for the disease are as follows:

(1) Road authorities to supervise all openings; companies to pay for cost of supervision, and be relieved of maintenance.

(2) Filling in to be carried out by "mechanical" rammers, at proper pressure, in layers of not more than 6 in.

(3) Surface material to be replaced immediately on a suitable foundation according to nature of roads, both to extend beyond the limits of the trench, and be incorporated with the materials of adjoining surface.

The author puts these suggestions forward as a basis for discussion, and if any agreement can be arrived at his object will have been attained.

ASSESSMENT OF SEWERS.

QUESTIONS IN THE COMMONS.

In the House of Commons on Tuesday Mr. Hogge asked the Secretary to the Treasury the number of cities or towns in the United Kingdom where sewers were rateable, and also the cities or towns where they were assessed to income-tax; whether he could state how many places were assessed or where income-tax was now being claimed in Scotland and England, respectively; whether there was any uniformity in the operation of such tax or any proposal to make such taxation uniform; and whether, until such uniformity was established for every case, the Treasury was prepared to waive their claims in isolated cases now, especially in view of the already heavy charges which such communities were bearing in common with all municipalities.

The Financial Secretary to the Treasury, Mr. Montagu, said he was informed that there were, approximately, in England and Wales 161, and in Scotland 229 such sewers which were rated, and with a few exceptions as to which inquiry was being made, these were assessed to income-tax, Schedule A. The practice of the revenue authorities was perfectly uniform, and proceeded on the principle derived from income-tax and rating law—that whatever was a proper subject for rating was a proper subject for assessment to Schedule A. Any change which was desired must be brought about by relieving sewers from liability to rates.

Contractor's Claim Against Cardiff Corporation.—An arbitration is proceeding at the Surveyors' Institution between the Cardiff Corporation and Mr. L. P. Nott, contractor for the Llwynon reservoir, near Merthyr. The claim, involving about £30,000, is in respect of extras, alleged excess in quality of work asked for in the specification, and compensation for damage to third party property in carrying out the contract. Mr. Edward Sandeman is arbitrator. Mr. W. W. Szlumper (for Mr. Nott) said the Cardiff Corporation had caused the expenditure of thousands of pounds by insisting upon such an extravagant class of work in connection with this reservoir among wild mountain lands, work that would have been much more in place, and would not have disgraced Westminster Abbey itself.

National Road Conference.

THIRD SITTING : THE CLASSIFICATION OF ROADS.

At the third sitting of the recent National Road Conference in London the subject under discussion was the classification of roads, introduced in a paper by Mr. G. Montagu Harris, secretary to the County Councils Association. An instalment of Mr. Montagu Harris's paper was given in The Surveyor of last week, and the remaining portion appears elsewhere in this issue. Sir W. Ryland D. Adkins, M.P., occupied the chair during the proceedings.

The Chairman said that, in their usual English fashion, after discussing subjects capable of precise and scientific treatment, they passed on to one of those problems of administration about which no one was precise, and no one ever dreamed of being scientific. They were not discussing subjects like the composition of road materials or the measurement of the benefits or otherwise of heavy traffic—all of which could be largely reduced to quantitative treatment—but they were dealing with a problem which had, for many minds, all the attraction of problems which were somewhat indefinite, and certainly of a problem which had not hitherto been solved. The paper combined the qualities of knowledge and vitality in a manner not always found in papers on such serious and weighty questions. One realised the great variety of questions which cropped up when they dealt with the classification of roads. The classification of roads was a matter of the merest academic interest if it did not associate with it the question of who was to pay for them, and who was to control them. The moment they came to these great problems of power and pay all the passions of human nature, including the less desirable ones, got their opportunity, and, like all practical problems, it was complicated by a singularly long and intricate history. They were told that many of the great roads of the country should be maintained and managed by the State, and they were at once confronted with the problem why one class of ratepayers should be freed from their burdens. The moment they went to another aspect, and asked that there should be one local authority of all kinds of roads, which should have power of classification, then at once the sacred question of the independence and vital sentiment of districts arose, and they were obliged to think not only of the roads being of the best quality, but of district councillors continuing to have that education in practical patriotism in making district roads as good as possible without raising the riot and rebellion of the ratepayer. All these things come to bear on what in itself would be a comparatively simple and even almost a scientific problem. It was perfectly certain that they would never reach a unanimous conclusion, and yet the question of the classification of roads was one which had to be faced and fought out, and it was one as to which they were moving, because they were steadily, as years went by, eliminating certain solutions as being inadequate or impossible. It was something that all concerned with local administration were agreed that the present state of things needed improvement, and must have it. They all realised that the utter change in the user of the roads must before many years mean grave and lasting changes in road administration, and they believed that to get a clear notion of the proper classification of roads was the indispensable preliminary to improved road administration, and in that way they would bring about that efficiency which everyone desired.

Mr. Dent (Essex County Council) said Mr. Harris had pointed out that the question of classification had been forced to a practical issue by its financial aspect. He urged that that day they would be wise to approach the question from the administrative side, because, after all, the finance of their highways was only one part of the very wide subject of the adjustment of the burden of national and semi-national services between the ratepayer and the Imperial taxpayer, and for all they knew the whole basis of taxation might be changed before many years passed. What they wanted to get at was the question of areas and authorities. Everyone would agree that they must have different classes of roads for town districts and rural districts, and two classes would probably be found sufficient for urban districts and three for the rural. Then they must have one central authority whose duty must be limited to control, and should not include administration. Then, with regard to areas, he did not think anyone would suggest that in the urban areas they could interfere with the existing authorities. The real difficulty was in the rural areas, and it was on that they should concentrate that day, and should ask whether they could remodel the units of areas in the rural districts so as to get a more efficient authority, and lead to a better administration of the highways. It seemed to him the alternative laid between the county councils and the creation of highway boards. The strongest argument in favour of highway boards was the growing tendency to create new county boroughs, which meant chopping out parts of the county council area and seriously depleted the financial resources of the county councils. Mr. Dent proceeded to show how the Essex County Council had been handicapped in this way by the creation of the boroughs of West Ham, East Ham, and Southend, and remarked that several other areas would probably apply for incorporation.

Mr. Pain (Surrey County Council) pointed out that there were fine large arterial roads through Surrey on which foreign traffic, having no connection with the county whatever, was very largely borne. They carried a large pleasure traffic, and the cost of the maintenance of the roads fell on local ratepayers, whereas those who largely used the roads did not even buy a cup of tea in the district. He pointed out how the Haslemere and Hindhead road had to be maintained by the Farnham District Council at great expense, and that the road was cut up by a half-hourly service of motor 'buses. His opinion was that a wise plan would be to make one central administration for the county, for he did not see how the finances of the county were to be managed unless they secured the rateable value of the urban districts.

Mr. J. W. Horton (county surveyor of Derbyshire) thought that in arriving at a system of classification attention should be paid to the importance of a road as a line of road from one town to another, and not merely as to the amount of traffic ascertained in a given week or period. Another point to be taken into account was that of the small highway areas, and more particularly the small urban areas, for there were in the county many so-called urban districts which were not urban in anything except name, but which retained the control of the roads in their hands without being able to do the work effectively. It was not in the interest of the county or of the country that small authorities of that kind should be charged with the maintenance of important lines of road. It was most essential that any central body which was appointed should have power to consider the retention of these small authorities. He agreed that urban councils with a population of 10,000 and upwards would be of sufficient importance, and have a sufficient staff to maintain the main roads in their district, but when they went down to small authorities of 2,000 or 3,000 they had not the organisation to cope with the work. In some counties steps had already been taken by which practically the whole of the roads in the county were maintained by the county council; that was so in Hertfordshire. He did not say that was a counsel of perfection for the whole of the country, but merely pointed out that it was an alternative which was not novel. The result had been an equalisation of the rates over the county, which was a great advantage. In most counties he thought it would be best that the county councils should not control all the roads. In large counties it was possible it would be better that the large mileage of third-class roads should still be maintained by the local authorities; but in small counties it might be advantageous to everyone if there was one authority, and that the county council.

Colonel J. B. Stracey-Clitherow (East Riding) said that in the course of the conference it had been suggested that the heavy motor traffic and the motor omnibuses should pay for the cost of the roads or that rates should be put on urban districts, and so on; but when all the traffic of the county was on the roads, their great-grandfathers settled the question by saying that those who used the roads should pay for them. If some scheme could now be devised by which persons using the road should pay for them it would be a great advantage.

Lord Farrer (Surrey) could not agree that there

should be any tax on the King's highway. The King's highway should be free, and perhaps they had not sufficiently considered what a highway was in England. It was, however, admirably described in the paper. He wished to bring forward one point which he felt had not been sufficiently considered. His district council had made up over 200 miles of hard roads, at practically no expense to the ratepayers, by the employment of labour in the winter. He did not think enough consideration had been given to the value of the clauses in the Highways Act, which allowed materials for roads to be got from manors. He believed county councils had not got that right, but the rural councils could get materials very cheaply in that way, and it appeared to him, before they ventured into large new schemes, they ought to consider carefully what the cost of them was going to be. Everyone would agree that conditions had so changed by the introduction of petrol that the question of road administration had to be faced, but he was by no means certain that a very large area necessarily gave better results than a more moderate area. With a mixed authority they would have one set of engineers going, perhaps, 50 miles away from their centre, whereas they might make the local authority sub-contractors just as well.

Mr. J. SPENCER-HILL (Enfield Urban District Council) considered that the area for the controlling authority should be as large as possible, and that there should be one highway rate, and that it should be made perfectly plain to every ratepayer what the roads really cost. The big trunk roads should be maintained by the Imperial Exchequer; but who should be the particular person to carry out the directions of the Government was a detail.

Mr. HENRY HOBHOUSE (Somerset) said they had seen their main roads made to conform to the functions of railways and canals, and this had forced on the question of classification, and who was to pay. Apparently there was not much difference of opinion with regard to classification. No one had objected to the proposal of last year to classify the county roads into three classes, but it should be clearly understood that this classification would have to be more than a classification in name and in respect of finance. It would have to be a classification in standard, and they must not expect a third-class road kept up to the same standard as even second-class roads. They could not keep up all their roads to the heavy-motor standard, and they must, as a necessary corollary, have the power to restrict heavy traffic to certain roads if they were to have any regard whatever for the country ratepayer. Then came the question of areas. There were the first-class roads, which they might regard as national roads used by persons who had no local interest. A large proportion of the expense of such roads should be borne by the Imperial Exchequer, but they must remember that, if the whole of the cost was borne by a national authority, they could not expect to have such roads locally administered. The second class of roads were the county roads, and most of them were roads maintained by the county authorities—not always directly, but sometimes by contract with the districts. On the whole he thought that system, varying although it did in different districts, had worked satisfactorily. There were arguments both for the maintenance of roads through the district authorities, and also for their maintenance directly by the county authority, and it depended very much on the efficiency of the staffs of the district authorities, which varied enormously. He suggested that the county council might be the authority, but might employ the district councils as their agents wherever they were satisfied that the staff of the district council was efficient. The small local roads ought to be left, as far as possible, to purely local bodies, or otherwise they would lose their interest entirely in local affairs. The suggestion for county highway boards was going back on a proposal in one of the old Bills; but those of them interested in county councils, and knew that, on the whole, they had worked well, would be very sorry to transfer any of their functions to a body which might not work so well. Joint committees did exist for various purposes, but they were not always easy to work. Speaking generally, he thought they might well welcome the proposals of the Departmental Committee, and might well trust to a classification, which should be conducted under the intelligent, friendly supervision of the Road Board.

Mr. A. W. WARD (borough engineer of Portsmouth) remarked that at the present time the roads were being used for military purposes, for which they were never designed. It was safe to say that had any authority taken into consideration the probability of their being used for such traffic many of the main roads would be very different from what they actually were. In his opinion, no authority ought to be able to come to a decision without provision being made for arbitration, and where a local authority had to pay, it ought to have some say in the matter. Even if the roads were kept up by the nation he thought the local authority ought to have some say, because they would be the people who would know the best kind of road for the neighbourhood.

Mr. H. HAMPTON COPNALL (Notts) said that those who had been engaged in highway administration must feel that the larger the unit of administration the more economical and successful was the work that was done. At the present time they had got local authorities who were directly responsible to the ratepayers who had done the work efficiently, and he thought those bodies could be trusted to continue the work. He believed that public opinion throughout the country would be in favour of county councils continuing the work which they had performed during the last few years in highway administration, giving them larger powers, if necessary, rather than see a new body come on the scene, and taking away some of the powers now exercised by them. He quite agreed with Mr. Hobhouse that a good deal could be done by employing district councils as agents, and he regretted that that practice had not been more largely adopted in the past. In 1891 an Act of Parliament was passed which enabled agreements to be come to between county councils and district councils in regard to the improvement of highways, and he had always thought it would be a good thing if similar agreements could be come to in regard to the maintenance of highways. What they wanted first of all was a classification of roads, and if the Road Board would bring forward an efficient scheme for that purpose he thought the common sense of the highway authorities might be trusted to get over the difficulties of administration.

Alderman LANG (Oldham) remarked that, to a very large extent, he agreed with the main points in the paper, but he would like to utter a word of protest against the author's suggestion of placing absolute authority in the county council. If the county council was to manage county roads, well and good; but it was quite a different matter if they were also to manage urban and district roads.

The CHAIRMAN said the discussion had shown what widespread agreement there was with the substance of the paper. As regarded trunk roads, emphasis had been laid by one or two speakers on the increase of that new and most important kind of traffic—which was national in the fullest sense—which passed hurriedly over the roads, and with ridiculously small benefit to the localities. While that had been emphasised, he thought it worth noting that there had been no definite support for having a system of trunk roads entirely detachable from local control. There was, he thought, an arguable case for having a certain number of trunk roads wholly maintained by the Road Board for military and other purposes. He noticed that practically every speaker had agreed with Mr. Harris that there ought to be a larger unit of administration and of finance, particularly with regard to roads which in any sense of the term could be called main. That brought them up sharply against two distinct problems. It was one thing to say that the power now possessed by small urban district councils under the existing law of managing their own main roads was a power which ought to cease, but it was quite a different problem to say whether the county authority was to take over the roads of rural districts which were really district in character. There was a great deal to be said both for and against that proposal, but they were two quite distinct things. He thought the feeling of the conference had been in favour of giving to a larger area and to a larger authority the management of all main roads, particularly those which went through these small district council areas; but at the same time it was undesirable to destroy altogether the local life of even the smaller districts. The rural district had always been a most difficult problem in local government, but its difficulty had been that it was impossible to get rid of it, and if it could not be got rid of it had got to be trained and governed. With regard to the question of so-called county boards or joint committees, he agreed with Mr. Hobhouse in hoping that they would not, except under the direst necessity, set up any more of those hybrid committees of authorities of equal power. As to the classification of roads, however they classified them they could never expect to have the smaller roads as

well made as the greater; but alongside with that there was the obligation that the general standard of road surfaces and of road management should rise. Mr. Hobhouse had pointed out the lines upon which the solution of the problem must proceed, and he (the chairman) agreed that there was room for variety of schemes in different counties. In road management there was more danger in uniformity than there was in variety.

The meeting concluded with a vote of thanks to the chairman for presiding, proposed by Sir Archibald Hepburn and seconded by Sir John Macdonald.

"DETAILS" FROM THE DARDANELLES.

[We are given the opportunity of publishing the following further extracts from letters written by a "Roadman" at the Front which, we think, will be of interest to our readers. They are interesting as showing what an individual is doing to help his country, and how this help, given in the right spirit, and multiplied by thousands, is the only way in which this war can be brought to an end. They are interesting also in showing that "good roads" are even more essential in war time than in peace, and that, as history has often shown us, the construction of roads during war has assisted the country enormously afterwards when the blessings of peace were again restored to the country.]

We are still busy, and have been working at night lately to avoid the shelling we have had occasionally during the day. Our work lately has been road work of a purely navvy description, and we should all welcome something a little more intelligent, but I suppose we must take these things as they come. Our camp is now quite a long way behind the firing line, and I haven't been up there for some days. Things are going on quietly and steadily. I don't suppose you get much news at home, and possibly you think that we are taking a tremendously long time, and are not making any progress; but, as a matter of fact, the job is progressing jolly well, although it is bound to be slow. The first landing was simply marvellous work, and with the troops who did that we ought to be able to tackle anything.

We had a day off about a week ago, and I walked into the base and saw Colonel C. and Lieutenant W. They were looking very fit, and apparently having a fairly busy time, although their work, of course, kept them down at the base mostly. I also had a look at the canteen—the, alas! dry canteen—which some Greeks have started down there, but found everything sold out barring sardines, soap, and tinned butter. I have since been able to get a supply of figs, but that is about all they keep. It will be quite a luxury to get such things as milk or fresh meat again. We get bread now, as a luxury, and find it quite a change from biscuit. But the thing we are all looking forward to is a drink. This is a particularly thirsty climate, and I find there is very little satisfaction in drinking water or tea, à la tea-leaves sans lait. We are all following the papers very closely and anxiously, and we sincerely trust that we shall be able to obtain such things as drinks in England when we eventually return.

We suffered very much at first from lack of news, and all sorts of rumours used to circulate. There was one very persistent one to the effect that Ostend and Antwerp had been recaptured. But now we have an official sheet, the *Peninsula News*, which is posted up daily, so we feel a little more in touch with things. We are jolly glad to hear that Italy has joined in, and think that ought to make things shift a bit.

ROAD AND BRIDGE BUILDING.

I wrote the above remarks *re* grub this morning before going out to work, and on returning at dinner found that quite a "Special this day" was on. I think it must be the quartermaster-sergeant's birthday. We actually have just had fried steak and boiled preserved potatoes, together with biscuit ad lib. (it takes very little to attain the ad lib. feeling), and about a quarter of a mouthful of weak lime-juice (irreverently referred to as slime-juice). The steak was somewhat tough, but I dispensed with my knife and chewed lumps off, and found it extremely tasty. So we are feeling quite pleased with ourselves and each other, and hope to continue so until it is time to start work again. Our morning's work was quite a brainy little game, which we often play at here, known as "Making Something out of Nothing." In this case the something was a road bridge over a small stream, and we succeeded in making it with a few empty ammunition boxes, some stones, some twigs, somebody's old trousers and pants, and lots and lots of earth. It was quite successful—excuse me a moment, but a shrapnel has just done a bust rather nearer than usual, and I must hie me under the overhang of my dug-out—in fact, nothing has gone over the edge yet, and, better still, nothing has gone through it. I haven't told you—have I?—that we are constructing the main road to Constantinople, and perhaps one day they will want a granite bridge where our little jig-saw puzzle is now.

I haven't seen the ex-local surveyor here yet, but I don't think he will want to do any gritting. He will probably want a rise in his salary when he gets back to work, owing to the increased mileage of the roads in his district.

There is another mail just in, which brought me a parcel that W. very kindly sent me. It contains, among other things, a small steel mirror, which I was simply horrified to look at just now. I would mention that I haven't had a shave for about a fortnight or a wash for about a week (except that I was out in the rain the day before yesterday), and that I had a French crop—clippers all over—a week or two ago. On referring to the mirror I find that, added to the above detractions, my complexion is a sort of dull purplish red with chocolate spots, and my hair is beginning to grow straight up like a German's. I am sorry to say I left my camera behind in my kit-bag at Port Said. It would have been jolly nice to have it here.

We have had one or two interesting jobs in the firing line since I last wrote you. One was a small night advance of a couple of hundred yards or so. One of us went with every ten men to see that they got the new trench right and the traverses properly spaced, &c. We formed up behind the firing trench with picks, shovels and rifles, and then, on the signal, we went over the parapet and bunked like billy-oh up to the new line marked out for us. Then we started digging like blazes until we had a bit of cover, after which we could take things a little easier. The chaps worked splendidly, and in two hours the new trench was practically finished, and we were ready for the Turks at any moment. We were in luck right through, as they never spotted us, and hardly a shot was fired until the job was done. Then there was a bit of firing on one side, and we fixed bayonets ready for someone to turn up; but nothing came of it, and our lot cleared out just before dawn and came back to camp for a sleep. Next night we were up again fixing barbed wire—rather a creepy sort of job—but we were in luck again, and succeeded in doing it on the Q.T. We have had rather a lot of that work, and, personally, I am always jolly glad to get behind the trenches again. Usually, just as we are going out in front of the lines the French will send up one of their beastly flare rockets, which light up the ground for miles, and we have to get down sharp and "freeze" behind a blade of grass. Then, when it is dark again, you dash round, putting in stakes or unwinding wire. It is quite exciting while it lasts—which isn't very long, if we can help it.

Apart from jobs like this (or like our first advance soon after we landed, when we had to follow up the front line pretty close, and under pretty stiff fire, to get to a house and fortify it), we are having quite a picnic. The weather is grand most of the time, although we have just—about ten minutes ago—had a sample of what it can do when it likes. We had about twenty minutes' mild rain here, when we were startled by alarums and excursions from most of our company, whose dug-outs are just round the corner. We were amused (they were not) to see a tidy-sized and exceedingly muddy rivulet coming at fine speed down the hill and heading for their dug-outs, which it proceeded to spring-clean and obliterate with great rapidity (especially the officers'). We turned out and gave them a hand to cut a channel and divert the stream to a new line, where it is probably now proceeding to flood other people out lower down. Our section is fortunate, as we happen to have picked out for our residential sites a diminutive valley which chances to be just out of the track of that water. As for our day's work—the home-made bridge I hear that when we go to look for it to-morrow we shall search in vain.

The Improved Wood Pavement Company, Limited, have we hear, invested £20,000 in the new War Loan.

Association of Managers of Sewage Disposal Works.

ANNUAL SUMMER CONFERENCE AT LEEDS.

(Conclusion.)

A visit to the Knostrop works was made last week, the proceedings of the twenty-second annual summer conference of the Association of Managers of Sewage Disposal Works including an address by Mr. George A. Hart, M.INST.C.E., the sewerage engineer to the Leeds Corporation, on the works of sewerage and sewage disposal embodied in the scheme authorised by the Leeds Corporation Act of 1905, and a paper by Mr. John L. Thompson, M.S.E., chemist and sewage manager of the Knostrop works, of which Mr. Hart is the designer.

In the ensuing discussion—the major part of which took place following a visit of inspection to the new works—Mr. J. B. Croll, Rochdale, contended that the paper of Mr. Thompson [reproduced in the present issue] would prove of the greatest interest and assistance to all who had the control of pressing plant at their works. The paper was particularly interesting to himself as a manager who had the control of some six presses, each capable of producing a ton of cake, and because he read a paper on the subject some years ago before the Society of Engineers. The chief item of interest then was the method of pressing cake—by compressed air or force pumps. Most people were agreed that the air-compression system was the best. He noticed that Mr. Thompson's method was to lime the sludge before pressing, putting the lime into the sludge six or eight hours before it went into the press. Their experience at Richmond had been that the sooner they put the lime into the sludge the better were the results. They too had had some difficulty owing to the breakage of plates.

The LORD MAYOR OF LEEDS (Mr. E. Bedford), in an allusion to the members' inspection of the Knostrop works, said he was gratified to learn how much the visit had been appreciated, adding that he hoped if anything that they had seen appeared wrong in their eyes they would not hesitate to say so. Mr. Hart, he was sure, would welcome any criticism, though he did not anticipate that much fault had been found with the scheme.

Mr. J. H. ABBOTT (Chiswick) said that he too experienced considerable trouble with broken press plates, and had dealt with it by enlarging the central holes. As a means of protecting the cloths he had taken off the sharp edges of the plates. With regard to the cloths he did not see any advantage in oiling these; it appeared to him to be rather a waste of time. He thought they had got hold of a very cheap lot of presses in Leeds.

The PRESIDENT said that one of the things that rather troubled him was the practice of putting two-thirds of the output of sludge on to waste land. It seemed to him a gross waste of material, in view of the fact that there were available now methods by which the pressed cake and by-products could be utilised.

Mr. G. W. WILLIS (Eccles) said that after looking at the detritus tanks at Knostrop the construction appeared to him to be rather faulty. The channels conveying the sewage to the screens were very narrow, and he would be interested to know how they answered when the works were put into operation. It struck him that the tanks would be a failure in case of a storm.

Mr. CROLL asked for some further information in regard to Mr. Thompson's statement as to the difficulty of getting the sludge cake off the press cloths. He was reminded of a difficulty he had experienced himself in dealing with sludge taken from a septic tank which had been at work for six months. The material was put in the presses, but the only result was to bind up the cloths, and although they kept on increasing the amount of lime they could not press the sludge at all.

Mr. J. BOLTON (Bury) put a question as to the percentage of grease in the sludge. In the course of further remarks he expressed astonishment that with only 1 per cent of lime Mr. Thompson was able to obtain satisfactory cake in one hour.

Mr. J. D. BROWN (Consett) and Mr. C. F. KING (Barnsley) contributed some observations on the question of the manurial value of sewage sludge, the latter remarking that the results obtained depended on the manner in which the material was applied.

Mr. C. H. BALL (Chorlton-cum-Hardy) said he thought that sewage sludge had considerable properties which farmers might with advantage make use of. Manure was sold from his works, but it was not the sludge from the sedimentation tanks, but that from the washers. Did Leeds pay anything to farmers to cart away the sludge, as was done in some places, or did the farmers pay something for the material? There was no doubt where they had to press sludge they must go in for the most economical material.

Mr. S. S. PLATT (borough surveyor of Rochdale) said he noticed that Mr. Hart proposed to instal straining filters below his humus tanks. He thought that was a wise precaution. Would Mr. Hart be good enough to give some particulars of these straining filters, and as to how he proposed to construct and work them relative to the humus tanks? Did he (the speaker) understand Mr. Thompson to say that after adding the lime to the sludge he was able to draw off 10 per cent of supernatant water and then leave 88 per cent of wet sludge? Also, did he find any advantage in output by his eight large sludge presses over the ordinary size of presses? Further, how many pressings and weight of cake per working day did he obtain from them? Before they dispersed he begged to move a hearty vote of thanks to the Lord Mayor and city council for their kindness in allowing the use of the council chamber to the members of the association for their meeting.

The vote of thanks was carried.

Mr. HART, in reply, said the humus tanks included in the scheme as a further process to follow the percolating or continuous filters were designed on the principle of upward flow to eliminate the semi-oxidised suspended matter or humus discharged from the bacteria beds, which from practical experience had been demonstrated to fluctuate in quantity very considerably. As a general average, during the year the suspended matter contained in the bacteria-bed effluent amounted to about 4 parts per 100,000, provided that the tank effluent applied to the filters had been subjected to effective chemical precipitation. But this average result had largely increased, as the filter periodically shed its intermittent discharges of solid matter, especially in the early spring and late autumn seasons of the year, and rendered the otherwise satisfactory effluent unsuitable to discharge into the river. Their experience had led them to the conclusion that a normal rate upon the dry-weather flow volume of 5 ft. per hour velocity in upward flow through the tank was the most suitable and effective, which, in time of maximum flow, could be increased to 10 ft. per hour without any considerable or material loss in efficiency. It was intended to insert a very shallow straining filter, of 6 in. in depth, of fine pea gravel in the upper portion of the humus tank, with facilities for reversing the direction of flow for washing purposes on the principle which had been adopted at Nuneaton by Mr. F. C. Cook with such excellent and economical results. The secondary filters included in the scheme were provided for in the estimates as a provision for future requirements in the event of the river Aire returning to its pristine condition of sixty years ago, when minnows were said by chroniclers to have abounded in its waters as it passed through Leeds. He was interested to hear from Mr. Willis that he regarded the design of their new screens and detritus set as wrong in principle, and that he anticipated their failure to accomplish their function in arresting the grosser inorganic solids contained in the crude sewage. The principle adopted consisted in employing a number of screens and pits working in parallel, the number in use at any particular time being governed by the volume of sewage and storm water flowing down the main sewer at the outfall works. The inlet channels to the detritus pits were designed to maintain self-cleansing velocities at least during two-thirds of the day during dry weather. Four pits and screens would take the whole wet-weather flow of 120,000,000 gallons a day, and one pit and screen would be operated for the dry-weather flow of 10,000,000 gallons a day. The screens were placed at the inlet to each pit to arrest all garbage, &c., and so prevent it intermingling with the deposited detritus. He held a strong view that this course was the correct one. As regarded Dr. Maclean Wilson's remarks, their experience in the recovery of by-pro-

ducts from sludge had not yielded any degree of success so far with Leeds sludge. Some experiments were undertaken about five years ago with a small unit designed to intercept ammonia liquor, oil or grease, and utilise gas generated from a percentage of the distilled sludge to supply the necessary heat for the retort. They failed, however, to overcome certain mechanical difficulties, which developed in their endeavour to establish the plant, and eventually had to remove the plant before they succeeded in operating it in such form as to enable them to obtain authentic records. Leeds sludge contained not more than 11 per cent of total grease measured on dry material, which was about a general average figure obtained from an ordinary domestic sewage of an urban population having a water supply of 20 to 25 gallons per head; 25 per cent of the total flow was contributed by manufacturing trade wastes of great variety, which considerably complicated and stultified the application of any prescribed course in recovering by-products. One or two enterprising firms were still experimenting with their sludge, however, and had the war not interfered with commercial enterprise he had little doubt a unit of plant would have been installed at their sewage works for recovering ammonia liquor and gas. As soon as circumstances permit, this would be proceeded with.

Mr. Thompson, in his reply, said it was interesting to note that Mr. Abbott had prevented breakage of plates by enlarging the central holes. At Leeds they had also found it necessary to file off the sharp inner edge of the plate to prevent it cutting the cloths, and any new plates they might require would be made more taper along the inner edges; but they had not broken a single plate since they put the extra bosses on in 1909. Mr. Croll evidently had found greater difficulty in pressing septic sludge than was experienced in Leeds. Referring to milk of lime supply, suppose a vat of lime was required for use at 6 a.m.; about midnight the limeman would start the mixer, and add lime at about ½ ton per hour until he had, say, 2½ tons of well-hydrated lime ready as hot milk of lime. When the sludge pump started at 6 a.m., the hot milk of lime was carried forward with the minimum volume of water to prevent sedimentation, and the remaining ½ ton of lime added towards the end of the operation to keep up the strength. In reply to Mr. Bolton, the 6 per cent grease was present in 60 per cent cake; if the cake was dried down to 10 per cent cake, the amount of grease would be double. The cake being discharged from the presses that afternoon was the normal product after one hour pressing with 1 per cent lime. The reason for applying sludge cake to land in late summer or autumn was because both the nitrogen and phosphates existed in an insoluble form, and the lime soaps formed from the grease required time to decompose. Cake was supplied to farmers free on rail or barge at the works. Screenings were readily taken by farmers at 1s. per ton free on rail. With regard to Mr. Platt's remark that thirty-two pressings per day of nine and a-half hours with eight presses seemed rather slow, it must be remembered that clothing the presses took time, and that, owing to defects in the plant mentioned in the paper, obstructions in the pipes, valves and drains took more time to clear than they should do; as a matter of fact, on at least two days per week thirty-six pressings were got out. His (Mr. Thompson's) statement that 10 per cent of the 90 per cent sludge was run off as supernatant water from the settling tanks, leaving an 89 per cent sludge to be pressed, was quite correct. The tank contained about 300 tons of 90 per cent sludge; 30 tons of supernatant water were removed, leaving 270 tons of sewage solids plus 240 tons of water—*i.e.*, approximately 89 per cent sludge.

BROADMEAD BRIDGE, WOKING.

A recent issue of *Ferro-concrete* contains an article by Mr. John Anstee, engineer and surveyor to the Guildford Rural District Council, descriptive of a ferro-concrete bridge which has lately replaced an old wooden structure spanning the river Wey. The design accepted is that of Messrs. L. G. Mouchel & Partners, the drawings providing for an arch bridge with a clear span of 50 ft., and a width of 22 ft. between parapets. The arch rib is 8 in. thick at the haunches, and 7 in. thick at the crown, which is 7 ft. above normal water level. The abutments are constructed on the cellular system, monolithic with the arch rib, and arranged so as to take the thrust of the latter in the most effective way. The spandrels and parapets are also of ferro-concrete, the latter being alternately panelled and pierced. The contractors were Messrs. Garrett & Sons, of London, by whom the work was carried out in a manner satisfactory to all concerned.

Broadmead Bridge.

Economical Road Construction.—The road surveyor to the Ellon District Council, Aberdeenshire, Mr. Forbes Philip, reports that the roads throughout the district are continuing to improve, and with a few exceptions are generally showing a good surface, notwithstanding the adverse weather conditions experienced during the past winter and spring. It is specially noticeable that those roads where bottoming has been applied and the surface coated with superior quality of metal are resisting the increasing volume of mechanically propelled traffic well. It is recommended that this improved system of strengthening the roads should be continued where practicable, for, although the initial outlay may seem heavy, it will ultimately prove economical.

Norwich Electricity Works.—The Norwich Corporation Electricity Committee reported on Wednesday that for the first time in the history of this undertaking the total output for the year shows a decrease, though slight, on the previous year. This has been due to the restrictions imposed on the public lighting, on account of the war, resulting in a reduced consumption of 142,253 units. The private lighting has been largely affected for the same reason, the increase being only 2½ per cent, as compared with an increase of 11 per cent in the previous twelve months. The output for motive power, which fell off on the outbreak of the war, afterwards recovered, and the total is slightly more than for last year. The financial result is as follows: The gross receipts for the year amounted to £57,261 3s. 2d., and the working expenses to £31,010 11s. 3d., leaving a gross balance of £26,250 11s. 11d. carried to nett revenue. The charges for interest and sinking fund are £18,237 1s. 1d., and the balance carried to appropriation account £8,013 10s. 10d.

Discharge of Open Rectangular Channels.

By G. S. COLEMAN, D.Sc.(Eng.), Assoc.M.Inst.C.E.

The present writer has recently had occasion to make some hundreds of calculations of the discharging capacities of open rectangular channels for the proposed extensions of the Davyhulme sewage disposal works of the Manchester Corporation, as now being designed and carried out under their engineer, Mr. O. J. Wilkinson, Assoc.M.Inst.C.E. He found that, whereas diagrams and tables exist in profusion, which enable the designer to estimate the discharging capacity and velocity of flow at any depth, in circular and egg-shaped culverts, similar diagrams for open channels, rectangular in cross-section, appear to be generally wanting. He therefore devised the following labour-saving table and diagram, and offers them for the use of members of the profession in the hope that they will prove as useful to them as they have to himself. Before doing so, however, he would like to make a short explanation.

It is still usual among municipal and drainage engineers to use the cumbrous formula of Ganguillet and Kutter, although eminent hydraulic experts—such as Prof. Unwin and others—have found that its apparent accuracy is mythical, even without taking into account the fact that the designer has eventually to make more or less of a guess at the value to be assumed for his "coefficient of roughness." The basis of the formula is, of course, that of Chezy, and with all its faults this primary formula will be used [illegible] of the modern exponential formulæ become more certainly known. The allurement of the Kutter formula is the immense latitude which it gives to the designer in his choice of the value of the experimental constant. To the ignorant also the complicated appearance of the formula offers great attractions. It may therefore seem strange, after the above remarks, that the present writer still uses the Kutter formula; but he only does so owing to the excellent labour-saving tables which are published in connection therewith, making use of the ingenious modification of the late J. Flynn, which much simplifies the work without impairing the nominal accuracy.

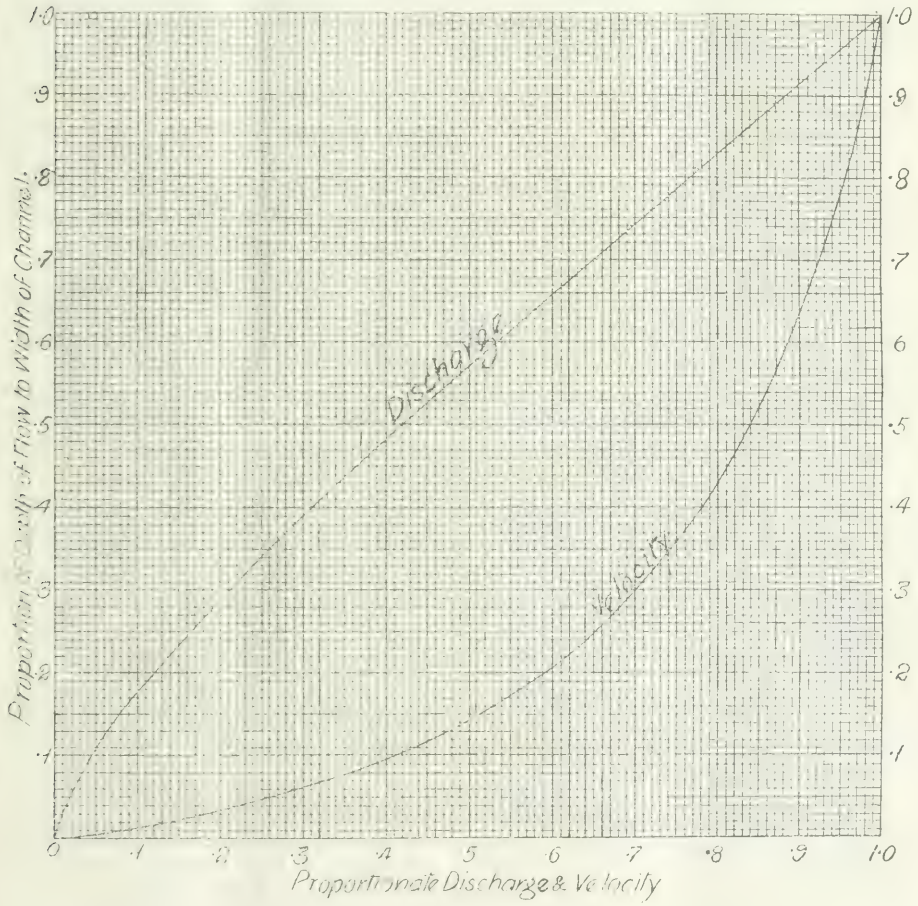

Fig. 1.

In calculating the maximum discharging capacity of an open channel, it is necessary to specify the limiting ratio between the depth of flow and width of the channel otherwise we have no criterion as to when the channel is to be considered as flowing full. The writer found that the simplest and most convenient way of overcoming this difficulty was to make the limiting depth of flow equal to the breadth of the channel, and on this basis table Fig. 2 was calculated. This table gives for values of n in Kutter's formula ranging from ·012 to ·017, the values of $c\sqrt{R}$ and $Ac\sqrt{R}$ for widths of channels ranging from 1 ft. to 20 ft., and of depths of flow of the same value as the widths, which values should cover all the usual cases. Intermediate values may be obtained by in- [illegible] diagram could be prepared, but

the writer has found it difficult to do this, owing to the wide range of the values given. The principal use the writer has made of the table was to find the depth of flow corresponding to a particular discharge for a channel of given width and slope. To do this quickly the diagram Fig. 1 was used. This diagram gives the fractional part which the velocity or discharge at any depth of flow less than the width of channel bears to the velocity or discharge when the depth of flow equals the width. These latter velocities and discharges are taken as unity, and the corresponding fractions are read off on the horizontal scale, the fractions corresponding to the depths being on the vertical scale. Suppose, for instance, we want the discharge of a 10-ft. rectangular culvert flowing 4 ft. 6 in. deep at a gradient of 1 in 1,200, and also want to see the effect of increasing the depth of flow to 4 ft. 9 in. Let it be considered that the proper coefficient of roughness is ·013, and that the value of $Ac\sqrt{R}$ for a 10-ft. culvert flowing 10 ft. deep is 25468. Then the discharge at 10 ft. deep is 735 cub. ft. per second. The value 4 ft. 6 in. is 0·45 of the full depth of 10 ft., and 4 ft. 9 in. is 0·475 of it. From the diagram we see that the coefficients of discharge for these coefficients of depth are 0·365 and 0·39 respectively. The discharge at 4 ft. 6 in. is $0{\cdot}365\times735=268$ cub. ft., and at 4 ft. 9 in. $0{\cdot}39\times735=286$ cub. ft., and the discharge at 4 ft. 9 in. deep is $\frac{286}{268}$, or 1·06 times of what it would be at 4 ft. 6 in. Other uses for the diagram will readily suggest themselves. For instance, suppose the normal discharge of the above channel carrying storm water is at a depth of flow of 2 ft., and it is desired to set an overflow weir at six times the normal flow. The coefficient of discharge corresponding to a depth of flow of 2 ft. is ·12 from the diagram. Six times this coefficient is ·72, which corresponds to a fraction of the depth of 10 ft. of ·76, or depth of flow of 7 ft. 7 in. This is the desired height of weir required. In this case it has been possible to use the diagram without actually calculating any discharge. The velocity curve of the diagram may be used in a similar manner.

The table may be also used to make another table to convert at once any velocity or discharge calculated with one "coefficient of roughness" to the velocity or discharge under any other coefficient. For instance, supposing we wish to convert the discharge of our 10-ft. culvert, flowing 1 ft. deep, as calculated with a "coefficient of roughness" ·013, to the discharge of the same culvert when the coefficient of roughness is ·015, the slope being the same in both cases.

The value of $Ac\sqrt{R}$, when $n=·013$, is 25468 for the 10-ft. culvert, and 22124 when the coefficient is ·015. Hence the multiplier is $\frac{22124}{25468}$, or ·868, and so on.

Width and depth in feet.	$C\sqrt{R}$				$Ac\sqrt{R}$			
	$n=$				$n=$			
	·011	·013	·015	·017	·012	·013	·015	·017
1	58·57	52·93	44·16	37·67	58·16	52·92	44·16	37·67
2	96·10	87·78	74·18	64·00	385·6	351·15	296·7	256·02
3	127·10	116·50	99·10	86·00	1146·6	1048·5	891·9	774·00
4	154·25	141·30	120·86	105·26	2468·0	2262	1933·8	1684·3
5	178·20	163·50	140·37	122·61	4155	4088	3509·3	3065·2
6	200·0	184·40	158·72	139·18	7221	6641	5714	5010·4
7	221·0	203·6	175·60	154·16	10820	9975	8605	7554·1
8	240·1	221·5	191·48	168·44	15384	14180	12255	10780
9	258·0	238·6	206·45	181·98	20951	19324	16723	14740
10	275·8	254·7	221·24	194·76	27585	25468	22124	19476
11	293·0	270·6	234·8	207·9	35331	32749	28411	25131
12	308·4	285·2	247·80	219·20	44410	41009	35660	31565
13	323·1	313·1	272·79	241·46	66321	61367	53450	47328
16	329·5	339·5	295·85	262·00	98854	86912	75739	67071
18	364·2	364·5	318·40	282·64	127410	118690	103100	91575
24	447·0	387·1	338·25	300·85	166820	154840	135301	120340

Fig. 2.

Pudloed Cement.—A large firm of Manchester architects report that they have had very excellent results by the adoption of waterproofed cement in a pit on Messrs. Holden & Brook's engineering works extension at Gorton, near Manchester. It is well known that engine and garage pits are particularly liable to flooding, especially in waterlogged areas; so that it will be of interest to architects and engineers to know that a Pudloed cement treatment so successfully [illegible] pit [illegible].

CUMBERLAND ROADS.

COUNTY SURVEYOR'S REPORT.

The length of the rural main roads under the direct control of the Cumberland County Council is, states Mr. William Finch, the county surveyor and bridgemaster, in his report for the year ended March 31st last, 456½ miles.

The expenditure on the surfaces of these roads during the period in question was £43,216, or, deducting amounts received from the Road Board and other sources, £36,495.

The average cost per mile on the total expenditure, including surface improvement works, was £94 13s. 10d., and after deducting Road Board and other receipts £79 19s. 4d. per mile, as compared with £74 13s. 11d. per mile on the nett expenditure during the previous year. Mr. Finch explains that the increased cost per mile is due to the additional amount of surface improvement works carried out during the year, and to the increased prices of materials, haulage and labour.

ROAD SURFACES.

During the past twelve months the ever-increasing heavy and fast-moving traffic has caused extensive deterioration in the weaker surface crusts of the main roads, where they have not been covered with approved surfacing materials, and its effect is also evident, although not to the same extent, on the newly laid granite water-bound surfaces, where they have not yet been treated with tar or other bituminous materials.

"The increased traffic during the past few years being thrust upon roads which were not originally constructed to carry such traffic has," the county surveyor observes, "to a certain extent revolutionised the wear and upkeep. In previous years the surfaces could be kept in satisfactory repair for a good number of years by judicious patching, but it is now found, especially where the crusts are of inferior stone, that the collapse of the surfaces under heavy traffic is sudden, and cannot be satisfactorily repaired unless the whole surface is re-sheeted.

"It is therefore evident that roads under present-day traffic must be more solid and durable in their foundations, with a surface that will minimise friction as far as possible.

"Further, present-day traffic demands that roads must now be constructed and afterwards maintained with a minimum of discomfort to the users, which demand has practically eliminated the system of patching with ordinary stone and clay binding, and it is now necessary to use tarred materials which can be more readily consolidated."

Mr. Finch remarks that previously the roadmen became so well acquainted with the particular length of road on which they worked, and the traffic using it, that they were able to patch the road where necessary in good time, and thus maintain a sound surface. This practice had now, however, become very difficult, and there seemed little doubt that future maintenance work would have to be carried out largely by gangs of men under a competent foreman, and the work closely supervised.

RESURFACING.

A considerable amount of resurfacing work has

The Surveyor
And Municipal and County Engineer.

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been carried out in every district of the county, both in water-bound granite and tar-macadam.

During the year there have been 204,472 sq. yds. of special water-bound surfacing laid, at a total cost of £13,070 13s. 1d., or 1s. 3·3d. per square yard. Towards the extra cost of this work the Road Board made a grant of £3,000. 21,114 tons of granite and whinstone were used, costing £6,930, irrespective of haulage from the railway stations, or an average cost over the whole county of about 6s. 5¼d. per ton.

Some of the sections, which were laid early in the year, were, the county surveyor states, surface-treated with tar during the summer months, and these surfaces show very little signs of wear.

TAR-MACADAM.

The area of tar-macadam laid during the year was 66,278 sq. yds., at a total cost of £8,313 13s. 1d., or at an average cost of 2s. 6d. per square yard. Towards the extra cost of this work the Road Board granted £3,000.

The amount of tarred granite used in this work was 9,553 tons, costing, irrespective of haulage from the railway stations, £6,136, or an average cost of 12s. 10d. per ton.

It appears that generally the lengths of tar-macadam which have been laid during the last four years are in a very satisfactory condition, but that one or two sections which were laid in 1910-11 are beginning to show slight signs of wear.

SURFACE SPRAYING.

On this matter Mr. Finch says: "It is essential that water-bound road surfaces, if they are to be maintained in a satisfactory state of repair, must be protected from the damaging effect of varying weather conditions by keeping the surfaces waterproof, and thus prevent the damage caused by the effect of severe frosts in the winter months.

"After careful observation of those sections of roads in this county which have been surface-treated with tar during the past few years, I am more than ever convinced that this surface treatment is most effective so far as rural main roads are concerned (where the weight of traffic is not continuously excessive) if carried out to a uniform specification, and with a suitable material.

"This surface treatment will, undoubtedly, preserve the roads and add to their life, which must therefore eventually prove economical in so far that the cost of re-sheeting per yard is so much in excess of a surface treatment with tar or other bituminous material.

"During the year I have used refined tar, Tarco, Tarvia and Fluxphalte upon the surfaces of various lengths of roads in the county, and 175,267 sq. yds. were sprayed both by direct labour and contract, at a total cost of £1,198 1s. 8d., or an average cost of 1·6d. per square yard.

TRENCH OPENINGS.

Dealing with the trench openings made in the roads for water, gas, sewerage, and other purposes, Mr. Finch says: "In the majority of these cases the road surfaces have been satisfactorily reinstated. This, I consider, is due to the system of obtaining a guarantee to this effect before permission is granted to break up the surfaces.

"In several cases, especially where it has been necessary to break into tar-macadam surfaces, arrangements have been made with the contractors and others for the reinstatement of the surface to be carried out by the county council's workmen, the cost of which has been charged to the former. I am of opinion that this is a more satisfactory means of ensuring that your road surfaces are not damaged to any greater extent than is possible."

NARROW ROADS.

As in previous years Mr. Finch has continued, where narrow roads have been resurfaced, to widen the carriageway to at least 21 ft. by utilising the grass margins.

FOOTPATHS.

The formation of footpaths along the verges of the rural main roads in the vicinity of towns and villages has also been continued.

HAULAGE.

As reported last year, there is still difficulty in many parts of the county in obtaining satisfactory team labour. This has been more keenly experienced since the commencement of the war, owing to the scarcity of horses. Applications have been made for increased rates of hire from all parts of the county during the year, and, after consideration, the following rates of hire have been fixed: Hire of horse, harness, cart and man, from 7s. 6d. to 8s. 6d. per day; hire of horse, harness and man, from 6s. 6d. to 7s. 6d. per day; hire of horse, harness and cart, from 4s. to 4s. 6d. per day.

The difficulty with regard to haulage has been lessened to some extent by the use of the new 5-ton tractor and two trailer wagons, which were purchased from Messrs. Marshall, Sons & Co., of Gainsborough. As the tractor, however, has only been in use some six months, a comparison of the cost against horse haulage can hardly be made. The county surveyor is satisfied, however, that, from the cost up to date, there is no doubt whatever that a considerable saving has been effected over the cost of team labour.

URBAN MAIN ROADS.

The continual watering of tar-macadam within the urban areas is criticised by Mr. Finch. The practice, he points out, is detrimental to the surface, and he suggests that if these surfaces were thoroughly cleansed twice a week in the early morning the collection of dust upon the surface would be considerably reduced, and the necessity of daily watering as now carried out in some of the districts obviated.

Fifty Years of Gas Engineering.—Mr. Charles W. Hastings, a well-known writer on the subject of gas engineering, is editing, and Messrs. J. G. Hammond & Co., Limited, London, are producing, a fifty years' review of the work of the Institution of Gas Engineers. The review, which carries many portraits, is entitled "Gas Engineering and Gas Manufacture, 1863-1913," and the first of six parts is to hand. The price is 2s. nett.

Storage Cisterns.—At the last meeting of Bromley (Kent) Rural District Council a letter was received from the Metropolitan Water Board stating that they had statutory powers to enforce the provision of a proper storage cistern, and were authorised to discontinue the supply unless statutory requirements were complied with. The board held the carefully considered opinion that it was necessary to enforce their powers, but in a number of cases where cisterns had been discontinued without reference to the board, the property owners had pleaded that the abolition was on the instructions of the local sanitary inspector. Mr. Nightingale, sanitary inspector, wrote that he had never served a notice, preliminary or otherwise, so worded as to convey the impression that abolition of storage cisterns is required, neither have cisterns been abolished on the instructions of the local sanitary inspector. Mr. A. Dunlop wrote in a similar strain in reference to his district.

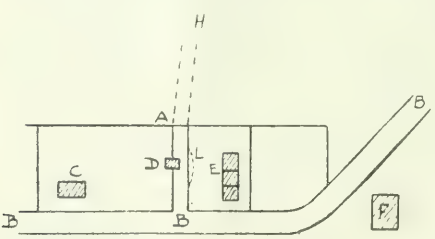
Law Notes.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter X, combinations such as* X.Y.Z., *and words such as* "engineer" *and* "surveyor," *should never be used.*

Obstruction to Footpath. "Premier" writes: Some five years ago the owner of the whole of the property shown on the plan was served with notice to carry out sanitary improvements to the cottage C, including the provision of an earth-closet. The surveyor and inspector to the council (rural), when asked as to the desired position of the earth-closet, replied: "Put it at the end of the garden, as far from the house as possible." The earth-closet was therefore built in the position D, and was passed as satisfactory. Three years later (last year) representations were made to the local parish council that the building D was an obstruction to an old public footpath BAH, and the parish council have forwarded the complaint to the rural district council. It appears that the footpath is a public footpath, and is represented as such on the



old parish map. It is fenced on both sides from B to A, and open across a field A to H till it rejoins the road BBB, a quarter of a mile on. For the last twenty years it has fallen out of use, the fences on both sides of B—A have overgrown the path, the stile at A has gone, and an ordinary fence has grown up, and the path has for years been quite impassable, and the public have used, as far as has been their need, another way. The rural district council have asked the owner of the property to open up the path B—A, and, in lieu of removing the earth-closet, to set back the fence opposite the earth-closet, as shown by the dotted line at L, but he declines to do any more than cut back the fences B—A. What powers ought the council to exercise in the matter? Is the question at all affected by the approval of the building D by the council's inspector, who was at the time, and for three years after, unaware of the existence of any public right of way? Can the council, in the light of this approval, give the owner notice to remove the building?

A permanent obstruction erected upon a highway without lawful authority is a public nuisance at common law, and the fact that it has been erected and continued with the consent or licence of the highway authority does not render it lawful (*Attorney-General* v. *Barker*, 1900, 83 L.T., 245). By sec. 26 (1) of the Local Government Act, 1894, "where a parish council have represented to the district council that any public right of way within the district . . . has been unlawfully . . . obstructed . . . it shall be the duty of the district council, unless satisfied that the allegations of such representation are incorrect, to take proper proceedings accordingly . . ." If the district council make default, the parish council may petition the county council, who may thereupon resolve themselves to exercise the powers of the district council in the matter. The obstruction from the building can be dealt with under sec. 69 of the Highway Act, 1835, and that from the overgrown fences under sec. 65 of the same Act.

Diversion of Gas and Water Mains Liability for Cost.—"W. L. F." writes: In my district we have two companies (gas and water) who are not authorised by Act of Parliament. The gas company has been in existence for upwards of fifty and the water company for about thirty-eight years. My council has lately carried out an extensive system of drainage, and had a resident engineer employed to supervise the contractor in the construction of the work. It was necessary, upon several occasions, to require either one or the other of the companies to divert their mains from the line of the new sewers, and the resident engineer, being in the employment of the council, without obtaining express authority from the council, would request the companies to do the work. This was the only notice ever served upon the companies, and as it came from the council's representatives it was acted upon without hesitation. The council has received a bill, through the contractors, for upwards of £100, delivered by the companies for work done in this connection, and the question now arises, Is the council liable for the cost? It is agreed by the parties that the companies, having no statutory powers, have no authority to lay their mains in the public highways. The water and gas companies claim that if the council intended to treat them as trespassers (*Goodson* v. *Richardson*, 1874), they would have ordered them to remove their pipes. On the other hand, the council's resident engineer requested them, in writing, to divert them to make room for the sewers. This was done, and the cost agreed to by the resident engineer and contractors at the times the companies submitted their bills to the contractors. The companies now claim that this work was done for the council, under sec. 153, Public Health Act, 1875, at the council's request, and now ask for payment. I should add that some of the pipes have been diverted by the companies at the request of the contractors, outside the urban district, the cost of which has been paid by the council. I shall be obliged if you will kindly inform me if you think the council, under the circumstances, are liable, and if you think the case of *Goodson* v. *Richardson* (1874) applicable.

The question here submitted is one of considerable difficulty, and is not, so far as we are aware, covered by authority. The following observations are therefore offered with some hesitation. By sec. 149 of the Public Health Act, 1875, "all streets, being or which at any time become highways repairable by the inhabitants at large within any urban district . . . shall vest in and be under the control of the urban authority." This statutory "vesting" does not give the urban authority any right to the soil of streets, but only to the surface and the "area of user" (*Wells* v. *Vestry of St. George, Southwark*, 1880, 14 Ch. D., 785)—that is to say, the soil beneath the actual road to such a depth beneath, and the space over the surface to such a height above, as is reasonably required to enable the urban authority to execute its statutory powers and perform its statutory duties (*Fareham Local Board and Fareham Electric Light Company* v. *Smith*, 1891, W.N., 76). In *Goodson* v. *Richardson*, 1874, L.R., 9 Ch., 221, the plaintiff was the owner of land adjoining a highway, and as such was entitled to the soil of the highway itself up to the middle of the road, and he was granted a mandatory injunction to compel the defendant to remove water pipes placed beneath the highway without lawful authority. This case is therefore distinguishable from the facts now submitted, which are more like those in *Battersea Vestry* v. *County of London and Brush Provincial Electric Lighting Company, Limited*, 1889, 1 Ch., 171, where the defendant company had illegally broken up the surface of a street in the plaintiff's district and placed their pipes and wires at a depth of about 2 ft. An injunction was refused on the ground that the vestry were not owners of the soil at that depth, and that there was no continuing trespass upon or interference with any right of the vestry. The present case is, however, distinguishable, in that the presence of the mains has directly interfered with a right of the council—viz., to provide a drainage system for their district—and in these circumstances it may be that an injunction would have been granted if sought. The council, however, have elected to deal with the matter by notices under sec. 153 of the Public Health Act, 1875, which is not in terms limited to pipes and mains laid under statutory authority, and we think that in these circumstances they are probably liable for the expenses incurred in the alterations as provided by that section.

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

Next week answers are invited to the following questions:—

493. Theory of Beams.—A girder is continuous over two spans of 20 ft. and 15 ft. respectively. What are the relative reactions of the three supports? (Inquirer.)

494. Strength of Pillar.—A solid, square pillar, 10 ft. in height, with a section 2 ft. by 2 ft., and weighing 50 cwt., is subjected to a horizontal wind pressure of 28 lb. per square foot on one side. Assuming its material to be uniformly elastic, find the intensity of compressive stress at the leeward edge and at the windward edge of its base.

495. Radius of Gyration.—Explain from first principles the precise meaning and significance of the term "radius of gyration" as used in the investigation of the theory of beams.

496. Stand for Procession.—A stand with seats is required, from which to view a procession, upon a site 40 ft. by 10 ft. The front is to be 4 ft. above pavement behind some iron railings. Give section and part plan to a ¼-in. scale.

497. Gauging Sewers.—Describe a suitable method for gauging the flow of sewers.

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

491. Books on Bridge Design.—Please give the name of a thoroughly practical book or books on the design of modern highway bridges. The book or books required must deal with the practical design rather than an accumulation of theoretical calculations, and must be up to date. (Tico.)

There is not, to the best of my knowledge, any book published dealing exclusively with the construction of modern highway bridges in the manner indicated in this question, but "Tico" will probably be able to obtain the required information by consulting the following books, all of which deal more or less with highway bridges: "Road Making and Maintenance," by Thomas Aitken (P. Griffin & Co. Limited); "Railway Construction," by W. H. Mills, M.INST.C.E. (Longmans, Green & Co.); "Reinforced-concrete Bridges," by Frederick Ring, M.S.A. (Constable & Co.); "Practical Treatise on Bridge Construction in Iron and Steel," by T. Claxton Fidler, M.INST.C.E. (P. Griffin & Co., Limited); "Roofs and Bridges," Part III., by Mansfield Merriman and Henry S. Jacoby (John Wiley & Sons; J. G. W., *Donaghadee*.)

492. Hydraulics: Adjoining Locks.—There are two locks side by side. The differential head of water is 11 ft., and the area of larger lock is 200 ft. by 40 ft., and that of the smaller is 120 ft. by 25 ft. The depth of water in cills when the lock is empty is 15 ft. The locks are connected by a sluice-way placed at the bottom of the lock, having an opening of 16 sq. ft. Neglecting friction and assuming the water to fall freely, calculate how long it will take to establish equilibrium with the sluice fully open. What allowances would have to be made in practice? (J. G. W., *Donaghadee*.)

Time taken to fill lock.

Let A and B sq. ft. be areas of locks, and a sq. ft. area of sluice.

H ft. be difference in level before sluice is opened.

At any instant, suppose

height of water in A is x ft. measured from initial and " " " " B " y ft. position of water in B.

Velocity of water through the sluice at this instant is

$$v = c\sqrt{2g}\sqrt{y-x} \text{ ft.-sec.}$$

Suppose in short period δt secs.

height in A decreases by δx ft.

and " " B increases by δx ft.

and that a quantity δQ cub. ft. flows through sluice

then $\delta Q = av\,\delta t = ac\sqrt{2g}\sqrt{y-x}\,\delta t = B\delta x$

$$\text{or } \delta t = \frac{B}{ac\sqrt{2g}} \frac{\delta x}{\sqrt{y-x}} \quad \ldots\ldots (1)$$

and since quantity of water which leaves A enters B we get

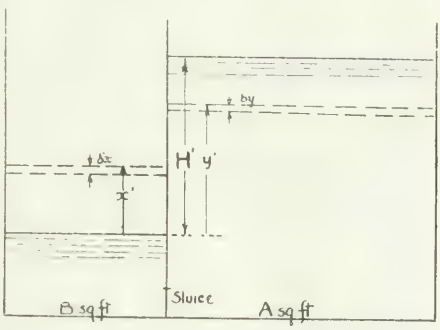
$$A(H-y) = Bx$$

$$y = H - \frac{Bx}{A}$$

When flow ceases (*i.e.*, $x = y$) $x = \frac{AH}{A+B}$

Substitute for y in (1)

$$\delta t = \frac{B}{ac\sqrt{2g}} \sqrt{\frac{A}{A+B}} \frac{\delta x}{\sqrt{\frac{AH}{A+B} - x}}$$



Time taken for x to increase from zero to $\frac{AH}{A+B}$ (value of x when flow ceases) is

$$T = \frac{B}{ac\sqrt{2g}} \sqrt{\frac{A}{A+B}} \int_0^{\frac{AH}{A+B}} \frac{\delta x}{\sqrt{\frac{AH}{A+B} - x}}$$

$$\frac{2B}{ac\sqrt{2g}} \sqrt{\frac{A}{A+B}} \left[\sqrt{\frac{AH}{A+B} - x} \right]_0^{\frac{AH}{A+B}}$$

Time to fill lock $T = \frac{2AB}{ac\sqrt{2g}\,(A+B)} \sqrt{H}$ secs.

c = coefficient for the orifice.

Area A = 200 × 40 = 8,000 sq. ft.

B = 120 × 25 = 3,000 sq. ft.

H = 11 ft. a = 16 sq. ft.

$$\text{Time} = 2 \times \frac{8000 \times 3000\sqrt{11}}{16 \times 8 \times 11{,}000\,c} = \frac{118}{c} \text{ secs.}$$

Neglecting friction and assuming c = unity, equilibrium will be established in about 2 minutes. Actually c will be less than unity and its value can be obtained from any standard work on hydraulics.

Urban Council By-laws.—The surveyor to the Caerphilly Urban District Council, Council Offices, Caerphilly, Glam., would be glad to receive copies of recently approved building by-laws of urban district councils.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is not the *Daily Mail* somewhat "off the track" when it suggests that municipalities "are still spending on the lavish scale of peace," and that there is need for investigation into the system by which local authorities are passing their men into the Army and "paying generous allowances out of the rates in addition to Army pay and allowances"? Are not the facts exactly contrary to these representations, and that, as neither loans nor labour are available at the present time, most of the local authorities throughout the country are carrying out only the urgently necessary works demanded by public health conditions? As to the "generous allowances" made by these bodies to their employees who join the Army, would not a glance through the columns of The Surveyor prove that in far too many cases the encouragement given to the patriotic ambitions of their employees has been grudging and meagre rather than extravagant?

* * * *

Was there not a rather remarkable letter in the *Daily Mail* of the 13th inst. from "An Inhabitant of Brussels" complaining that our present system of road making creates difficulties for persons on horseback? Arguing from this that we do not know how to make roads, and must go to Belgium to learn, was it not rather offensive to say that England was forty years behind the rest of the world? Have not many of us cause to remember the noise and jolting to which we were subjected on the Belgian roads, including those of Brussels, before the war broke out?

* * * *

Is it possible to imagine a tramway system that has been more unfortunate in its working than that of the London County Council? Has it been left to Mr. H. N. Casson, "the Demosthenes of business organisation," to discover or invent a worse case when he tells us of a place called Bunkerdoodle Land, where, in connection with their tramway system, "nobody wants to ride; when they do ride, nobody pays; and if they do pay the conductor steals the lot"?

* * * *

Does it not seem to be almost incredible that a country should allow itself to have drifted into such a position that a strike of coal miners should imperil its very existence? Will recent happenings be easily forgotten, even though a compromise has been so speedily aranged?

* * * *

Have many surveyors who have public parks or recreation grounds under their charge read the excellent little pamphlet, published by the National Rose Society, entitled "Municipal Rosé Gardens"? Would not a perusal of this pamphlet show them that rose gardens or roseries are an endless source of delight to the public, and that under the auspices of the society they can be installed and maintained at very little cost, if any, and that such roseries, where they have been established, are more popular than any other part of a park when the roses are in bloom?

* * * *

Has not experience with bituminous carpets for road surfaces, so far as our present knowledge of the subject goes, proved that the proper proportion of bitumen or asphalt is one of the main factors which decide whether the carpet will be a failure or a success? If this is so, does it not appear that, with the ordinary methods of mixing now employed, it becomes almost an impossibility to ensure that every batch of mixed material shall contain in it every portion of the mass mixed to exactly the right proportion? Cannot some failures be attributed to the fact that in every square yard of the carpet there are variations in the percentages of the materials?

* * * *

When the war is over, and affairs are more settled, is it not to be hoped that some progressive local authority will seriously consider the question of a more scientific and sanitary method of house refuse collection than that which obtains at the present time? Is it not lamentable that, notwithstanding the danger from this refuse, principally owing to flies, the same primitive methods of collection have been in vogue for something like forty years?

* * *

Is it not to be hoped that the work of the National Physical Laboratory at Teddington, since the commencement of the war, has been of assistance to the military and naval authorities? Is not the annual report rather reticent upon this point? But may we not gather that this useful institution has not been backward in giving assistance in a scientific direction to the paramount work which is now exercising the minds of our Government and the country at large?

* * * *

Apropos of the work of the laboratory in connection with road tests—which appears to have proceeded uninterruptedly—do not the experiments and trials tend to show that a road surface "carpet" should approach, as nearly as possible, the various rock asphalts which Nature has provided?

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Bideford U.D.C. (July 21st. Mr. P. M. Crosthwaite).—£4,739 in respect of extras in connection with a scheme for the improvement of the water supply.—It was explained that the extras consisted largely of additional excavating in the upper reservoir to increase its storage capacity. The inspector inquired how many thousand cubic yards were provided for in the original estimate. Mr. Baldwin Latham (the engineer): "30,000, while an additional 11,740 were done, of which 3,426 were rock, which had to be paid for as extras. The work of excavating is a success."

Southampton T.C. (July 13th. Mr. A. W. Brightmore).—£14,000 for the construction of a water tower in connection with the waterworks undertaking.—The waterworks engineer, Mr. E. C. Rodda, said there had been complaints for some years. The inspector remarked that, of course, at the present time it was not the intention of the board to sanction any expenditure unless it was a pressing necessity for public health or war purposes. It was desirable that there should be a tower to supply this high-level district, but the question was whether the board would consider it a necessity.

Walsall T.C. (July 21st. Mr. F. H. Tulloch).—£40,000 for the purpose of widening and improving Lower Bridge-street.—The town clerk, Mr. H. Lee, said that not only was the scheme in the public interests and unopposed on its merits, but in addition the need for putting it in hand was urgent—so much so that unless the opportunity which had now arisen was accepted the town would have to say good-bye to any hope of carrying out a much-needed improvement. The mayor, Alderman Cotterell, in supporting the application, described Lower Bridge-street as the main artery of the town, and said that if the actual cost had been £40,000 instead of surplus land being available for sale, as would be the case, the improvement would still have been worth the money.

APPLICATIONS FOR LOANS.

Cornwall C.C.—£1,230 for the purpose of a proposed sanatorium.

Falmouth T.C.—£320 for works of sewerage.

Halifax T.C.—£24,000 for electrical plant.

Sherborne U.D.C.—£4,000 for the sewage disposal scheme.

Walsall T.C.—£40,000 for the purchase of property for street widening.

LOANS SANCTIONED.

Ambleside U.D.C.—£805 for works of sewerage.

Birmingham T.C.—Electric supply undertaking, £253,414; tramways undertaking, £76,652; works of sewerage, £27,170; street works, £17,000; hospitals, £8,594; school playing field, £2,169; police station, £2,190; new school in Ryland-road, Erdington, £12,420—total, £399,844.

Gloucester C.C.—£1,128 for the provision of a manual instruction class-room at Gloucester.

Leeds T.C.—£30,724 for the electricity undertaking.

Lewisham B.C.—£500 for the purposes of a depot.

Skegness U.D.C.—£1,000 for water main extension.

FORTHCOMING INQUIRIES.

JULY.

		£
27.	**Epsom.** For the purposes of sewage disposal and the provision of clinker-breaking machinery (Mr. A. W. Brightmore)	5,515
29.—	**Leyton.** For the purposes of the electricity undertaking (Mr. A. W. Brightmore)	18,158
29.—	**Lowestoft.** For works of sea defence (Mr. H. Shelford Bidwell)	7,500

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Maldlesbrough, Swansea; refuse disposal—Boston; roads and materials—Bradford, Greenock; sewerage and sewage disposal—Bishop Auckland, Oadby; water, gas and electricity—Nuneaton. Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Adwick U.D.C. A scheme is to be prepared for new municipal offices, and meanwhile it has been decided to purchase a site for the buildings.

Batley T.C.—Plans have been approved for a substation in connection with the electricity undertaking.

Itchen U.D.C.—The question of providing a number of baths for the district has been referred to the Sanitary Committee.

Lewisham B.C.—The Finance Committee recommend the acceptance of the London County Council's offer of a loan of £500 for the purchase of property at Rushey Green, recently used as a fire station.

Middlesbrough T.C.—Negotiations are in progress with the Hartlepool Corporation for the provision of a joint sanatorium.

Paignton U.D.C.—The surveyor, Mr. C. O. Baines, has received instructions to prepare an estimate of the cost of repairing the sea wall.

Sunderland T.C.—The borough surveyor, Mr. J. W. Moncur, has received instructions to construct an inspection pit for motor engines and a petrol store at the fire brigade station.

Swansea T.C.—It has been decided to build a new isolation hospital, at an estimated cost of about £40,000.

Whitehaven T.C.—The borough surveyor, Mr. E. E. Stiven, as assessor, has selected for the purposes of a joint small-pox hospital for the borough and several adjoining urban and rural areas the design prepared by Mr. H. Irving Graham, of Harrington. The estimated cost of the scheme is £3,500.

HOUSING AND TOWN PLANNING.

Chard T.C.—The borough surveyor, Mr. E. W. Hearn, has prepared a specification for three cottages in Old Town, which has been approved by the council.

Doncaster R.D.C.—It was reported that a conference had taken place between representatives of the council and the Adwick-le-Street Urban Council with reference to the town planning scheme for the Carcroft area, when it was recommended that the scheme should be carried forward by the Doncaster Council, with the co-operation and assistance of the Adwick-le-Street Council. The recommendation was unanimously adopted. It was also decided that the area of the proposed scheme for the town planning of Armthorpe and the surrounding neighbourhood be approved.

REFUSE COLLECTION AND DISPOSAL.

Boston T.C.—The Local Government Board have written that they approve generally of the town council's proposals with reference to the erection of a refuse destructor, but they were advised that as the cells proposed are only just sufficient for present requirements, the grate area should be increased so that the capacity would be such as to meet requirements for the next twenty or twenty-five years; that the horizontal wind pressure on the roof should be taken at 56 lb. instead of 30 lb. on the square foot; and that the council should satisfy themselves that it is necessary or advisable to instal a boiler of the size proposed. Before replying to the Local Government Board, the council decided that the chairman of the Sanitary Committee and the borough surveyor, Mr. G. E. Clarke, should inspect the destructor at Hove.

Slough U.D.C.—In the course of his annual report the sanitary inspector, Mr. J. H. Glover, states that most of the houses are now supplied with a covered galvanised iron dust-bin, the refuse being collected at least once per week from each house by the council dustmen and conveyed in covered carts to the refuse destructor and burnt to a clinker. During the past year 190,952 calls have been made for the collection of house refuse, and the whole amount, consisting of 2,867 loads, has been carted to the refuse destructor. The total weight of refuse collected and destroyed (assuming the average weight of a load to be 1 ton) is 2,867 tons. The average number of calls per house per annum has been 52·2. Another point, especially when dealing with the fly nuisance, has been the weekly removal of horse manure from stables.

ROADS AND MATERIALS.

Aberdeen C.C. The Alford District Committee have entered into a contract for the reconstruction of the road from Kildrummy to the quarry at Ardhuneart, at a cost of £700.

Bermondsey B.C.—The question of the paving of Queen Elizabeth-street was raised at the last meeting. It was the intention of the General Purposes Committee that granite pitchings should be substituted for wood blocks from Tower Bridge up to within 11 ft. of St. Olave's School. Through a misunderstanding, pitchings had been laid down right up to the corner of the building. Councillor Vezey said the committee had since visited the school, and were satisfied that the granite pitchings increased the noise from the traffic considerably, and they had given instructions for the pitchings to be replaced by wood blocks up to the end of the school playground. The mayor (Councillor Hart) hoped the committee would not continue their system of "economy" in the future.

Blean R.D.C.—The council are seeking for urban powers for the purpose of paving certain roads under the provisions of the Private Street Works Act, 1892.

Bradford T.C.—The minutes of the Street, Drainage, and Works Committee included a recommendation that certain private street works be carried out at a cost of over £2,500. Alderman E. Cash asked that this work should be delayed until after the war. The chairman of the committee, Mr. A. T. Sutton, replied that the committee were doing work of this character only where it was absolutely necessary, and did not feel that they would be justified in putting all the work off until after the war. The council approved the minutes.

Chesterfield T.C.—The scheme for the proposed new street from Spencer-street into Saltergate is postponed for the present. The estimated cost of £3,500 has led the Estates and Development Committee to report that they cannot recommend the town council to proceed further with the scheme.

Dorking U.D.C.—A scheme for the improvement of High-street and Mill-lane is to be submitted to the county council with a view to obtaining a contribution towards the cost.

Droitwich R.D.C.—Six weeks ago a resolution was adopted suspending all work on the roads for three months in order that the roadmen might work for the farmers. The surveyor, Mr. J. V. Wall, in carrying out the resolution, stopped all contract work and stone hauling, and the members felt that this was going further than they intended, but the surveyor contended that after the resolution of the board he would have had trouble with the auditor if he had allowed any work at all. At Wednesday's meeting a member proposed the rescinding of the former resolution, and it was stated that much damage had been caused to the roads by the thunderstorms, and that one motorist had threatened to bring a claim for damages against the council. It was also reported that the roadmen, instead of working for farmers, had obtained employment on the county council roads, and were in receipt of more wages. The motion to rescind was carried, and the surveyor was authorised to proceed with all contract and stone-hauling work, and to employ roadmen in cases of accident or necessity.

Enniskillen R.D.C.—At the council meeting recently a protest was entered against proceeding with new works. Two works, already provisionally passed and each costing over £100, came before the meeting, and Mr. Geddis said that the council would be stultifying themselves by throwing them out now. Other members protested against the expenditure at the present crisis.

On a vote being taken it was decided to proceed with the works.

Fifeshire C.C.—Mr. James Millar, Waulkmill, at a meeting of Dunfermline District Committee recently, made a complaint as to the dangerous condition of certain of the roads in the district. This, he asserted, was the result of tar-macadamising operations, which were carried out according to the specifications of the Road Board. He suggested it would be better to refuse the grant by the board rather than expose vehicular traffic to such danger as was now being experienced. The effect of the tar-macadamising was simply to create dust on the surface of the roads. A number of accidents had already occurred in consequence of the state of the roads. The road surveyor defended the action of the committee, and stated that similar operations were being carried out all over the country. The matter was referred to a committee for report.

Greenock T.C.—Consideration is being given to a scheme for the reconstruction of the main street from West Burn to Rue End-street, at an estimated cost of £7,300.

Guildford T.C.—The council have accepted the offer of the Improved Wood Paving Company to lay with wood blocks the portion of High-street between the Town Bridge, Friary-street and Farnham-road, at 7s. 5d. per yard, an increase of 10 per cent on the amount quoted last year.—The town clerk submitted a letter from the county surveyor, stating that he was in some difficulty as to certifying for further payments to the corporation on account of main road grants, in view of the fact that little progress had been made with the special resurfacing works it had been agreed should be carried out by the town council during the three years ending March 31, 1916.—The council have approved the draft conveyance by Mr. A. G. Taylor to the council of the land contracted to be acquired for the purpose of the London-road improvement.

Heywood T.C.—It has been agreed to make up Back Hind Hill-street for a distance of 55 yds.

Highworth R.D.C.—The surveyor, Mr. O. Kimber, has received instructions to complete the road from the Ridgeway to the southern end of the camp at Draycott for the military authorities.

Holyhead U.D.C.—The surveyor, Mr. A. Asquith, has received instructions to proceed with the tar-spraying of the roads. The Road Board have sanctioned a grant of £65 towards the cost of the work.

Itchen U.D.C.—The Local Government Board wrote sanctioning the borrowing by the council of £720 in respect to the improvement of the road leading from Woolston to Netley Hospital. No portion of this amount, however, could be expended by way of wages to the council's employees. The surveyor, Mr. T. A. Collingwood, pointed out that he was in a difficulty, inasmuch as he only had the council staff. The military authorities had asked him to do the work as quickly as possible.—Mr. Vokes suggested they should write to the Local Government Board, and it was understood that this course would be adopted.

Kingsbridge R.D.C.—Several contractors for road work having declared themselves unable, owing to the increased cost of horse fodder and labour, to carry out their contracts at the prices agreed upon, it was decided to advertise for new tenders for one year for four parishes.

Lambeth B.C.—The council at their last meeting rejected a motion to put all works out to contract.

Lewisham B.C.—The Finance Committee recommend the acceptance of the London County Council's offer of a £1,915 loan, at 1½ per cent, to defray the council's proportion of the further expenses incurred in the improvement of Bromley-road, London-road, and Stanstead-road.

Louth T.C.—A steam roller has been purchased from Messrs. Ruston, Proctor & Co., for the sum of £537.—The borough surveyor, Mr. G. H. Allison, has received instructions to prepare a scheme for the improvement of the corner at Burnthill-lane and Queen-street.

Newhaven R.D.C.—It has been resolved to purchase a motor cycle for the use of the surveyor, Mr. Arthur C. Groves, and to allow £10 per year for its upkeep.

Norton U.D.C.—The surveyor, Mr. L. Tait, has been directed to prepare an estimate of the cost of placing Park-road in such a state of repair as would enable the council to declare it a highway repairable by the inhabitants at large.

Rutland C.C.—An intimation has been received that the Road Board have sanctioned a grant of £400 towards the cost of tar-spraying the main roads.

Totnes R.D.C.—A committee, appointed to go into the question of increases on contracts, recommended, with the exception of contracts recently re-let, that, subject to the sanction of the county council, a bonus of 7½ per cent be given to the main road contractors for hauling, ripping, breaking, and manual work, subject to a reduction of 25 per cent on all the contract quantities, as previously decided by the council; that 1s. per day extra be allowed for single horse and cart, and 1s. 6d. a day for a pair; that 3s. 6d. a day be paid for day work—all payments to be made in respect of the year ending March 31, 1916, only, and to be regarded as payments made in addition to the contracts, on the understanding that the contracts in force were in no way broken or affected by the extra payments. The council have approved the report so far as it relates to district road contracts.

Uxbridge R.D.C.—A loan of £1,000 has been taken up for the purpose of the East Brent road improvement scheme.

Walsall T.C.—The council on Monday approved of a scheme for the widening of Lower Bridge-street to 60 ft. It is proposed to purchase certain properties now at a cost of £40,000, and to suspend further operations until after the war.

Westbury U.D.C.—The surveyor, Mr. C. G. M. Cross, submitted tenders for tar-macadam, which were deferred from the meeting in March until the allowance from the county council for main roads had been decided, and the council accepted that of the Emborough Stone Company.

Wolverhampton T.C.—The Streets Committee, in a report on the treatment with tar of certain secondary residential roads in the borough, recommended the adoption of a scheme prepared by the borough engineer, Mr. G. Green, under which roads in Stafford-street, Great Brickkiln-street, and Monmore Green districts are to be tar-sprayed. The amount of £600 which appears in the committee's estimate for paving with wood a portion of Lichfield-street is to be allocated to cover the cost, and also the expense entailed in executing necessary repairs in Lichfield-street.

SEWERAGE AND SEWAGE DISPOSAL.

Bishop Auckland U.D.C.—The council are asking the Treasury for a confirmation of the sanction already given by the Local Government Board of a loan of £11,000 for the Cockton Hill sewerage scheme.

Chesterfield T.C.—The council recently rejected a proposal to send back to the Health Committee a notice calling upon the owners of certain property to convert sanitary conveniences to the water-carriage system.

Durham R.D.C.—It is intended to execute sewerage extensions at Auton Style, at an estimated cost of £100.

East Molesey U.D.C.—It was reported that at a meeting of delegates from this council, Esher and the Dittons, and the Walton authorities, it was decided that the three authorities' surveyors should confer and submit a report as to a proposed scheme for the prevention of floods in their own respective districts, and that these reports should be made into a combined report to be submitted to a meeting to be convened at as early a moment as possible, when the matter might be again fully discussed, and the committee would then have something definite before them.

Oadby U.D.C.—The council have notified the Local Government Board of their intention to prepare a scheme for the extension of the sewage disposal works, and to borrow £4,600 for carrying out the scheme.

Worcester T.C.—The Water and Sewerage Committee on Wednesday presented a report in which was stated that Messrs. Jones & Attwood, of Stourbridge, had proposed to carry out at the sewage disposal works an experiment with the activated sludge process of sewage purification on a large, instead of a small, scale. It was stated that the terms were that, if the process was proved successful, the council should take over and pay the cost of the work executed, estimated at £1,360. If not successful, no payment was to be made, and the firm were to restore the works so that they would not be less efficient for their purpose than they were at present. The city engineer, Mr. T. Caink, reported that the works, as they were, appeared

to be singularly adapted for the experiment. The council agreed that the experiment should be tried.

WATER, GAS, AND ELECTRICITY.

Belper R.D.C.—The county medical officer, Dr. Barwise, has urged upon the council the necessity for an efficient water supply for Allestree. The clerk said it was a matter that would have to stand over until after the war unless the capital was found locally. Perhaps some wealthy person would be willing to find the money. A councillor said all the wealthy people had gone to the war. The matter then dropped.

Clutton R.D.C.—The tender of Mr. Stevens, of Stanton Drew, at £117, has been accepted for works of water supply at Upper Stanton.

Darlington T.C.—The town council are seeking the sanction of the Local Government Board to a scheme for the extension of the gasworks which is estimated to cost £6,500.—In connection with the corporation scheme for water services it was decided to press the Local Government Board to reconsider their decision, they having declined to permit the council to borrow £1,000 for this purpose.

Foleshill R.D.C.—The council recently approved the draft agreement with the Newdigate Colliery (1914), Limited, for a supply of water to the parish of Bedworth. The committee had instructed the engineer to prepare plans and estimates for a reservoir and water softening plant. The agreement with the Newdigate Colliery stated that the company were to supply the council with 120,000 gallons of water per day, and a further supply of 30,000 gallons per day on due notice being given. The council were to pay 4d. per 1,000 gallons, with a minimum payment of £730 per annum. The agreement, which was to remain in force for forty years, might be determined by either party at the end of the first seven years.

Keighley T.C.—An outlay of £3,225 will be incurred for the provision of foundations, piping, and switch gear in connection with the installation of a turbo-alternator at the electricity works.

Mansfield T.C.—The profit on the electricity undertaking in the last financial year amounted to £1,941. This was earned in spite of the extra cost for coal and wages.

Nuneaton T.C.—The Water Committee recommend the corporation to apply to the Local Government Board for a loan of £2,000 for a water main extension.

Ossett T.C.—The borough surveyor, Mr. H. Holmes, has been asked to prepare a scheme of tar distillation.

Penistone U.D.C.—The council have agreed to take up a loan of £580 for works of water supply.

Peterborough R.D.C.—Proposals for an extension of the Werrington water supply at an estimated cost of £700 have been referred to the parish council.

Stratford-on-Avon T.C.—It is proposed to provide a dehydrating tar plant, at an estimated cost of £400.

MISCELLANEOUS.

Bath T.C.—It was reported by the Sanitary Committee that the services in connection with the troops were largely performed by Mr. W. A. Craven, sanitary inspector, outside office hours, and very eulogistic reference was made to his work before the departure of certain regiments. The Army Council had expressed its willingness to pay for all extra services rendered to the troops. It was desirable that Mr. Craven should have some means of moving more quickly from place to place in the performance of his duties, and Mr. Craven was going to invest a grant of £75 in a motor cycle with side car, which would economise both his own time and that of the corporation. The minutes, which provided for the paying of the running expenses of the cycle when used for the council, were agreed to.

Teddington U.D.C.—Owing to the increase in the price of coal and to the extra cost of labour the Hampton Court Gas Company have increased the price of public lighting from £2 19s. 6d. to £3 4s. 2d. per lamp per annum.—Mr. M. Hainsworth, the surveyor, having reported the death in action of a dustman formerly in the employ of the council, it has been resolved to continue for twenty-six weeks the allowance paid to the deceased's mother.

Doncaster Housing Scheme.—In the plans competition for the Doncaster Corporation housing scheme, the first place has been awarded to Messrs. J. C. Ireland and C. H. Hanscomb, of Ealing. There were over 100 competitors.

PERSONAL.

Mr. Herbert Catlow, assistant borough surveyor of Darwen, has been recommended for a commission in the Territorials.

Mr. George Kingswell, Shanklin, has been appointed assistant in the surveyor's department of the Fareham Urban District Council.

Mr. Alexander McDonald Cobban, of Winterton, has been appointed surveyor and inspector to the Brumby and Frodingham Urban District Council.

Mr. Ernest C. Bond, assistant surveyor to the Foleshill Rural District Council, has been voted £50 for acting as clerk of works on the housing scheme.

Mr. Joseph Day, who was borough surveyor of Glastonbury from 1871 to 1889, died last week, we regret to state, aged seventy-nine. He had been totally blind for some years.

Mr. Alexander Lindsay, Kirriemuir, was on Monday appointed road surveyor for the Forfar district of Forfarshire, in succession to the late Mr. Donald Ross. Mr. Lindsay had acted as assistant to Mr. Ross.

Mr. Deputy Douglass Mathews, F.R.I.B.A., F.S.I., will on November 30th relinquish the office of district surveyor for Stoke Newington. He was appointed to the position by the Metropolitan Board of Works in 1874.

Mr. Robert Forster, divisional road surveyor, Alston, who joined the Westmorland and Cumberland Yeomanry, has received a commission as Second Lieutenant in the 11th Battalion of the King's Own Yorkshire Light Infantry.

Lieutenant T. D. Pinks, who is at present serving with his ship in the Dardanelles, has just been gazetted temporary Lieutenant-Commander. He is the son of Mr. E. C. Pinks, the well-known quantity surveyor, of Parliament Mansions, Westminster.

Mr. G. H. Rampling is recommended by the General Purposes Committee for the post of deputy or assistant borough surveyor and assistant inspector of Sudbury, at a salary of £150 a year. The borough surveyor, Mr. W. J. Tait, is serving with the military forces.

Mr. M. R. Jones, surveyor and inspector to the Abergele Urban District Council, having resigned, the council considered the question of appointing a successor. It was urged that for the present there was no necessity to appoint a successor, and that the salary should be saved. A motion to this effect was carried, the appointment being deferred indefinitely. An amendment was moved, but defeated, that the appointment be deferred until after the war, the chairman urging that it would give young men now fighting a chance of a position.

Mr. A. E. Collins, city engineer of Norwich, has received public recognition of the patriotic service he rendered to the Lord Mayor of the city in seconding his Worship's successful efforts to raise a battalion of the Norfolk Divisional Royal Engineers. Mr. Collins was among those of whom the Lord Mayor took counsel when he determined to initiate the movement, and on the occasion of a public inspection of the battalion recently his Worship stated that "his thanks were due to Mr. Collins, city engineer, for his ever-ready and unsparing help in the matter of offices, barracks, and their equipment, which he did in his characteristically perfect manner, unforgetful of every detail."

WOOLWICH BOROUGH ENGINEERSHIP.

Mr. L. Roseveare, M.INST.C.E., borough engineer and surveyor of South Shields, who was recently appointed borough engineer and surveyor of Woolwich, has intimated his non-acceptance of the office, and the Works Committee of the borough council now recommend the appointment of Mr. J. Sutcliffe, ASSOC.M. INST.C.E., borough engineer and surveyor of Deptford, one of the three selected candidates. The salary is £500, rising by annual increments of £50 to £650.

"An Abominable Proposition."—At a meeting of the Bletchley Urban District Council recently, Mr. Chignell moved the rescinding of the resolution continuing the salary of the surveyor, Mr. J. Chadwick, during his absence on active service. The resolution having been seconded, Mr. Bourne said he could not understand such an abominable proposition being made to honourable men as to ask them to break their word. Mr. Stevens, Mr. Clarke, Mr. Kirby, and Sir Herbert Leon also spoke. Only two members voted for the resolution, which was consequently lost.

HIGHWAY MAINTENANCE IN THE ISLE OF WIGHT RURAL DISTRICT.

Mechanical haulage in the Isle of Wight Rural District, states Mr. L. A. Cozens, the highway surveyor, in his annual report, greatly increased last year, many firms having to a large degree done away with horse labour and replaced this by steam or petrol vehicles. Mechanical haulage has also much increased owing to the large demand for transport by the War Office, and many roads which were not previously largely used by this class of traffic have had the weak spots shown up.

As a result of the abnormal rainfall during the winter months much damage was occasioned to the surfaces of many of the highways by scour and wash, and it was found that in most instances the existing drains, culverts and bridges were quite inadequate to carry away the flood water.

Mr. Cozens mentions with pleasure that where the highways had been tar-sprayed, and particularly where the tar was in good condition, the roads did not suffer nearly so much as in places where no tarring had been done. The heavy rains were, however, most useful in acting as a scavenger for the roads, as, owing to their quantity and frequence, much less scraping of mud was done than hitherto.

SUBSOILS.

It would appear that the question of defective subsoils is one which is causing considerable anxiety (and expense) in the maintenance of the roads, as in most places the sides forming the haunch or abutment of the roads are extremely weak, owing to the lack of sufficient cover, either of foundation or topping material; in fact, in most places the material is more conspicuous by its absence than its presence, and Mr. Cozens points out that this lack of strength at the weakest point of the roads is the chief cause of their spreading and distorting under heavy traffic. "They can," he adds, "only be improved by a gradual strengthening by filling with hard material, and covering the whole road width when metalling, or in the worst places by providing a proper abutment to the road."

AN IMPROVEMENT SCHEME.

Mr. Cozens makes a reference in his report to a scheme which has been adopted by the council for the resurfacing, strengthening and drainage of nearly 40 miles of the most heavily trafficked main roads, towards the cost of which the Road Board have agreed to make a grant of £10,000 and a loan, free of interest, of £33,000. He mentions that the scheme involves the purchase of 49,510 tons of granite, and 3,400 yds. of gravel for filling low sides, and the use of about 7,105 yds. of binding material.

The scheme is arranged so that the work is spread over a period of five years, involving the purchase of about 10,000 tons of granite annually for these five years, and the expenditure, roughly, of £10,572 per annum, and the financial scheme has been so worked out that, allowing for the grant of £10,000, and the loan of £33,000, the cost of the work will be spread over a period of eleven years, involving a varying cost, including the repayment of the loans, of from £4,457 the first year, down to £1,600 in the last year.

COST.

There are in the Isle of Wight Rural District a total of 232½ miles of main roads, and 86 miles of district roads. In the year under review the expenditure per mile on main roads was £60 5s. 5d., and that on district roads £10 17s. 8d., these figures being exclusive of establishment, legal and salary charges. The total expenditure, inclusive of those charges, was £15,994 7s. 6d., equalling £50 4s. 4d. per mile, or £14,970 17s. on main roads, and £1,203 10s. 6d. on district roads, equalling £64 8s. 10d. and £11 18s. per mile respectively.

New Bathing Pool at Scarborough.—The new bathing pool constructed in the South Bay, Scarborough, was formally opened on Wednesday by the Mayor (Mr. C. C. Graham). The pool is oval in shape, and extends landwards 350 ft. and seaward 190 ft. The depth of the water varies from 3 ft. to 7 ft. It has a broad promenade on the landward side, with slipways from the beach. The pool is so arranged that the sea flows into it at high tide, and tests have proved that the temperature of the pool is about five degrees warmer than the sea itself. The cost of the scheme was £5,000.

Newquay Drainage Scheme.—The Newquay (Cornwall) eastern drainage scheme, carried out at a cost of £12,000, was formally opened on Tuesday last. Mr. J. Ennor, the engineer, in the course of a statement at the luncheon, said the length of the sewer was 2¼ miles, 1¼ of which was open trench and deep cutting to a depth of from 4 ft. to 20 ft. The tunnelling was ¼ mile in length, entered by eight shafts, of depths varying from 40 ft. to 110 ft. About 6,500 tons of débris was taken from the tunnel. It was an engineering feat seldom met with in a scheme of such small dimensions. All the work had been done without a single accident. The sewer would be discharged on the ebb tide, and would hold 200,000 gallons between high and low water.

FOR OTHER ADVERTISEMENTS

See End of Paper.

EPSOM RURAL DISTRICT COUNCIL.

TENDERS FOR GRANITE.

The above-named Council invite Tenders for the Supply of about—

8,000 tons of ½-in. Broken Granite,
500 tons of ⅝-in. Granite Chippings, and
200 tons of ¼-in. Granite Chippings,

during the period ending 31st March, 1916.

The deliveries to be in such quantities as may be required to any of the following stations—viz., Ashtead, Banstead, Bookham, Cheam, Epsom, Cobham, Oxshott, Ewell, Leatherhead, Worcester Park, Tadworth, and Kingswood.

Samples must be sent to the Council's Surveyor, Mr. T. E. Ware, Waterloo-road, Epsom, on or before August 16th.

The successful Contractor will be required to enter into a Contract to supply in such quantities and at such times as the Surveyor may require, and to maintain deliveries to his entire satisfaction.

Tenders are to be delivered on Contractors' forms on the 23rd August, and addressed to the Chairman of the Epsom Rural District Council.

The lowest or any Tender will not necessarily be accepted, and the Council reserve the right of accepting the whole or any part of any Tender as they may determine.

ARTHUR R. COTTON,
Clerk to the Council.

Waterloo-road,
Epsom.
July 21, 1915. (2,651)

RURAL DISTRICT SURVEYOR (Practical) willing to assist county, rural or urban; the same applies to Contractors in road making and sewerage works. Age 41, single; life experience.—Apply, Box 1,532, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (2,649)

TOWN COUNCIL OF THE BOROUGH OF SUDBURY.

WORKING FOREMAN.

The above-named Council invite applications for the post of Foreman for their Borough.

Applicants must have had experience in the control of men for Street Scavenging, Watering, Road Making, Tar-macadam, Spraying, Paving, &c., and be able to undertake the inspection of Sewers, Drains, and Water Mains.

Wages, 30s. per week.

Applications, in candidate's own handwriting, to be addressed to the Mayor, Town Hall, Sudbury, Suffolk, and endorsed "Foreman," must be delivered not later than 5th August, 1915.

G. H. RAMPLING,
Deputy Surveyor.

July 21, 1915. (2,648)

CINDERS.

100 TONS PER WEEK

TO BE DISPOSED OF.

Good accommodation for loading barges.—Apply, J. & J. M. Worrall, Limited, Ordsall-lane, Salford. (2,647)

STEAM FIRE ENGINE FOR SALE.

A Merryweather's modern horse-drawn Steam Fire Engine, capable of delivering 400 to 500 gallons per minute; suitable for mansion, works or camp.

Engine may be inspected at Fire Station, Barnet, Herts. Offers, in writing, to H. W. Poole, Solicitor, Barnet, Clerk of the Barnet Urban District Council. (2,650)

The Classification of Roads.*

By G. MONTAGU HARRIS, M.A., Barrister-at-Law, Secretary to the County Councils Association.

(*Conclusion.*)

It is more difficult to estimate how the second class would be composed. The Departmental Committee's suggestion is that this class should include "all roads in administrative counties which, though less important than main roads, first-class roads, may yet be regarded as serving more than merely local purposes." This is vague; but, judging by the Departmental Committee's estimated grant for these roads—viz., £600,000, as compared with the cost of maintenance—and striking a balance between the average cost of maintenance of a rural main and a rural district road (about £75), it would appear that the committee contemplated that the second class would include about 30,800 miles, or 22 per cent of the total outside London and the county boroughs.

This would leave 80,832 miles of roads and streets in the third class, of which a large proportion would be in the non-county boroughs and urban districts.

I must confess myself at a loss to know how to allocate the mileage of second and third class roads between urban and rural districts. This, I think, can only be arrived at by means of a complete return such as is, no doubt, now in the hands of the Road Board.

There seems to be one objection to the system of classification suggested by the Departmental Committee—namely, that no distinction is made between the smaller streets of a non-county borough or urban district and the minor country roads. In this respect the recognition in France of a "Voirie Urbaine" and a "Voirie Rurale" is far more scientific and practical, and something of the kind was recommended by Sir George Gibb in his memorandum to the Departmental Committee. The same object might, no doubt, be attained by the introduction of sub-classes, and perhaps the simplest method would be to divide each of the three classes into "urban" and "rural," the former applying to all roads and streets in London, boroughs or urban districts, and the latter to all other roads.

The Departmental Committee suggest that there should be only two classes in London and the county boroughs, but it might be convenient to the authorities for their own purposes to have three classes, and it is therefore suggested that, in the case of London and the county boroughs, the central authority should classify the roads and streets as "first-class" and "second or third class," leaving it to the local authorities themselves to differentiate between the latter if they think fit.

Judging by the grant proposed by the Departmental Committee for London and the county boroughs, and the method (set out above) upon which the grant is to be calculated, it seems to be estimated that there would be about 1,300 miles of first-class roads on these areas.† As these roads are confined to "the continuation of all the recognised main roads impinging on the boundary of the borough . . ." it is obvious that, in most large towns, a number of fine streets—perhaps the very finest—would be, technically, not in the first class. Looking at the system of classification as a basis for the distribution of grants—and it seems that, for practical purposes, this must be so—such an anomaly is, perhaps, unavoidable. This, however, makes it all the more desirable that the town councils should be able, if they wish, to classify their non-grant-earning streets on lines which would not conflict with the general system.

On the basis considered above, the eventual classification may be summarised as follows, in round figures:—

Administrative counties.	Urban.	Rural.	Total.
First class ...	4,500	23,500	28,000‡
Second class	16,800	35,000	30,800
Third class			81,600
London and county boroughs.			
First class	1,300	—	1,300
Second or third class ...	11,000	—	11,000
	33,600	118,500	152,100

* From a paper read at the recently held National Road Conference in London.

† This figure is arrived at by putting the cost of maintenance of the main roads in the urban areas of the administrative county or counties adjacent to London or a county borough at £300 per mile.

‡ Including, perhaps, 3,500 miles of "Trunk" roads.

ADMINISTRATION: CENTRAL OR LOCAL.

As looked at from the point of view of the local authorities, the question of the classification of roads is closely bound up with that of highway administration. There is a very general opinion that some reform in the system is necessary, especially in the direction of reducing the number of highway authorities, and any change of this description must greatly affect and be affected by the adoption of a general scheme of classification.

Whether or not the Government have had in contemplation any general alteration of the present system one cannot say; but it certainly seems probable that the legislation necessary for the establishment of a scheme of classification will be accompanied by something of the kind.

One thing that appears certain is that there will be no suggestion of the establishment of a large central department corresponding to the Ministère des Ponts et Chaussées of France or Belgium no "national roads" in the sense that their maintenance and control will be withdrawn from the local authorities. No voice has ever been raised in this country in support of such a system, and it may therefore be treated as altogether outside consideration.

There is, however, the suggestion, already mentioned, of the recognition of a class of "trunk" roads. It is not proposed that the administration of these roads should differ from that of the other first-class roads, the main distinction being as to the amount of grant for their maintenance from the Exchequer. It is, however, worth while to mention here one practical point which might follow from such a recognition. It would enable these roads to be numbered on the same principle as the Routes Nationales in France, the numbers being given in large figures on the milestones and sign-posts. This is undoubtedly a great convenience to rapid, long-distance traffic, and could not be carried out unless, in some way or other, each numbered thoroughfare were recognised as one road from end to end, no matter how many areas of highway authorities it might pass through.

ADMINISTRATION OF ALL ROADS BY ONE LOCAL AUTHORITY.

The next question that arises is whether all roads—first, second and third class—within a particular area should be maintained by one authority, and, if so, what should be the area chosen for this purpose?

UNIT OF AREA.

The advantages of a large unit of area for highway administration are being every day more and more generally recognised.

The Third International Road Congress resolved that, "A principle that can be laid down as of universal application is that the unit of highway administration shall be sufficiently large and command sufficient resources to employ and adequately remunerate a competent staff."

If it is admitted that a large area is desirable for this purpose, and if it were to be agreed that all roads within that area should be administered by the same authority, the next question is, What should this area and authority be? And one answer to that question would be, The county council. This would necessarily involve the complete abolition of the highway powers of the district councils.

It is to be observed that the Departmental Committee on Highways of 1903 declined to recommend this course on "sentimental" grounds alone.

COUNTY COUNCIL AS SOLE AUTHORITY.

The report contributed by Mr. H. Hampton Copnall to the Third International Road Congress, with the assistance of the Right Hon. R. C. Munro Ferguson, M.P., Sir A. Buchan Hepburn, Mr. J. Hodgkin, Mr. T. H. B. Heslop and Mr. J. E. Jarratt (Lord Strachie and Mr. Seymour Williams dissenting), recommended that all roads, except "local roads"—viz., ordinary streets in towns and urban districts . . . village and country lanes, footpaths and rights of way, which are but little used except by local residents, and will not require a trained engineer to maintain them—

should be under the control of the county and county not such councils.

The following advantages are claimed for this course:

(1) There would be uniformity of administration throughout the country.

(2) The roads of the country would be brought up to a uniform standard of excellence.

(3) There would be less overlapping, because there would be fewer highway authorities, the most important roads being entirely vested in one authority —viz., the county authority.

(4) The throwing of the burden of expense upon larger areas will tend to relieve the burden upon particular parishes and districts.

It is of interest to note that the county councils themselves have gradually come to realise the advantage of a large area as the unit for road maintenance. As stated by Mr. Rees Jeffreys, "When they were first instituted many county councils adopted the district council as the unit of highway administration, and employed them to maintain the main roads. One by one they have found by experience that the district unit is not successful, and at the present time (1913), of the sixty-two county councils in England and Wales, forty-eight councils maintain the main roads by direct maintenance, eight councils maintain some roads by direct maintenance and some by contract with the district councils, and only four councils now maintain the main roads in the rural areas by contract with the district councils. Of these four, in three cases the question of maintaining the main roads by direct labour is now under consideration."

It would certainly seem that if it is more economical and otherwise more satisfactory for county councils to maintain their main roads direct than to contract with the district councils (as to which it is obvious that they will have satisfied themselves before making the change), it would be even more economical that the one organisation, staff, plant and machinery should be used for all the roads in the area than that the work should be divided among a number of smaller bodies.

The views of the Departmental Committee on Highways on this point have already been quoted.

The main objections to this course, apart from the opposition of the district councils, would appear to be the reluctance of many county councils to take upon themselves any additional duties, and the fear that it would lead to further "officialism." It may safely be said, however, that it is the busiest county councils which find the least difficulty in undertaking new duties, while upkeep of the roads is a matter in which the technical expert must of necessity play the largest part, and, provided that the staff is properly subordinate to the council and the Highways Committee, it is difficult to see in what respects "officialism" can be a danger in this department.

If it is contended that in many cases the county is too large an area for economical working, the reply is that districts of an appropriate size can be marked out, which could be worked in with one another as a part of the county system. In connection with this point, reference might be made to the Scotch system, under which there are no district councils, but district committees carrying out the executive work of their respective areas under the control of the county council, to which they are subordinate. This system avoids the possibility of friction between two mutually independent bodies, but could not, of course, be established in this country without a complete alteration in our local government law.

DISTRICT COUNCIL AS SOLE AUTHORITY.

In opposition to the view that the county should be the unit of area for highway purposes is one which was expressed by Lord Strachie and Mr. Seymour Williams in a memorandum appended to Mr. Copnall's report, and which, it is understood, represents the opinions of the Rural District Councils Association. This is the proposal that the district shall be the sole unit of area, within which all roads shall be maintained and administered by the local council, the cost of the main roads being repaid on a certificate of the county surveyor, and these roads being, consequently, to some extent, under the control of the county council.

It is, of course, the case that this system would avoid the present evils of two highway authorities having jurisdiction in one area, that it would enable many district councils to afford more efficient surveyors, plant and machinery than at present, and would bring more immediate local interest to bear on the roads.

On the other hand it would do little to cure the acknowledged evil of a superabundance of highway authorities (since it would merely abolish the sixty-one county councils as highway authorities, leaving 1,836 in existence), and it would entirely prevent the enlargement of the unit of area.

COUNTY HIGHWAY BOARDS.

One other method by which all classes of roads may be administered by one authority is that of "county highway boards." This method was favoured by the Departmental Committee on Highways so far as concerns the principal roads of a county, but it might conceivably be applied to all roads. As this would mean, however, the administering by a wider authority of all the streets of county boroughs, it is not likely that the proposal would meet with general acceptance.

DIFFERENT CLASSES OF ROADS UNDER DIFFERENT AUTHORITIES.

These being the three methods by which all classes of roads might be administered by the same authority, we may now consider the manner in which the different classes might be dealt with by different authorities.

The Departmental Committee on Highways were of opinion that the system of county highway boards was "ideally the best possible under the existing conditions of local government in England and Wales." They proposed that such boards should be "representative of all the authorities having at present rights and powers with regard to main roads," and that all the principal roads in a county should be under their direct control. Presumably this would apply to the first-class roads. Whether counties, county and municipal boroughs and urban districts would willingly combine for this purpose it is difficult to say. The Departmental Committee realised that the adoption of this proposal "would involve the solution of some intricate problems with regard to proportion of representation upon the boards and to finance." Such problems are, no doubt, not insoluble, but they are certainly so difficult that, in spite of the many advantages which such a scheme holds out, it is probable that a simpler solution would be preferable.

If the first-class roads are not to be administered by a central authority or by county highway boards, it seems obvious that they must be placed under the control of the counties and county boroughs, with, perhaps, the power of retention by boroughs and urban districts, as in the case of main roads at present.

As regards the second-class roads, it would probably be best to have an elastic system, under which different methods of administration might be adopted in the different counties. It would facilitate this, and in many instances be very useful, if power were given to the district councils to contract with the county councils for the maintenance by the latter of the district roads. The converse is already possible, and there seems no reason why this power should not be given.

The third-class roads would naturally be left to the district councils, the parish area being universally recognised as too restricted in size and resources for such a service.

Specific recommendations as to the method of administration of the three classes of roads if the existing system is not fundamentally altered, were made by the County Councils Association in July, 1914, as follows:—

(1) That a borough or urban district having a population of not less than 10,000 should have power to claim to retain any first-class roads within their areas, and in such case such roads should be, for all highway purposes, vested in the borough or urban district council, and should be called first-class borough roads or first-class district roads, as the case may be, provided that any borough or district council which has claimed to retain a road should have power subsequently to surrender such road to the county council whenever they may think fit.

(2) That all other first-class roads should be known as first-class county roads, and should be, for all highway purposes, vested in the county council.

(3) That, except as hereinafter provided, all second-class roads should be, for all highway purposes, vested in the borough or urban or rural district council, and should be called second-class borough or district roads.

(4) That a county council should have power to claim to retain any second-class roads which were

main roads before the passing of the Act, and that a borough or district council should have power by agreement to surrender to the county council any second-class road within their area. Any such roads should be, for all highway purposes, vested in the county council, and should be known as second-class county roads.

(5) That the borough or district councils should be solely responsible for the third-class roads within their area, and such roads should be, for all highway purposes, vested in them, provided that they should have power by agreement to contract with the county council for their maintenance, provided also that a county council should have power to claim to retain any third-class roads which were main roads before the passing of the Act, and that a borough or district council should have power by agreement to surrender to the county council any third-class roads within their area, and that in any such case the county council should be responsible for the entire cost of such roads, and the roads should be vested in the county council.

These proposals, if carried into effect, would ensure that the county councils should be the authorities in respect of the following roads:—

(*a*) First-class roads not within the area of a borough or urban district with population of 10,000 or over.

(*b*) First-class roads within the area of such a borough or urban district which the borough or urban district council do not claim to retain, or which, having claimed to retain, they subsequently surrender.

(*c*) Second or third class roads which were main roads prior to the alteration of the system, and which the county council claim to retain.

(*d*) Second-class roads which a borough or district council by agreement surrender to the county council.

The borough and district councils would have the control of all other roads.

It will be observed that these proposals would avoid some of the difficulties and complications which at present exist, and would provide facilities for the transfer to the county councils of roads which are at present under the control of borough and district authorities, if the latter desire it, but that they would not effect any general alteration of the existing system or any reduction in the number of highway authorities.

FINANCE.

It is undoubtedly the question of finance which has chiefly led to the classification of roads in this country becoming a practical policy. The revival of the road as a means of communication has of recent years led to a general recognition of the fact that the maintenance of roads is, to a large extent at any rate, a national service, and should therefore, to a large extent, be paid for out of national funds, and in order to facilitate this, some systematic classification is an absolute necessity. So generally is this recognised that it is unnecessary to labour the point here.

Owing to the fact that it was from the financial point of view that most, if not all, the commissions and committees made their recommendations, it is to be expected that this will affect the manner in which the classification will be brought about. In other words, it is highly probable that the Road Board will, in making their classification, be guided by the amount of the fund which the Government propose to distribute.

This conference, however, need be hampered by no such consideration. The question is—assuming that roads are divided into first, second and third class—what authorities should finance each class, and to what extent. Then we may estimate what, on this basis, the amounts of contribution from the several classes of authorities will be, and whether the Government proposals satisfactorily meet the case.

Having eliminated the idea of national roads administered directly by a central department, we may also take it for granted that no roads will be maintained entirely at the cost of the National Exchequer. It is, however, for the reasons above given, generally agreed that a large proportion of the cost of maintenance of the principal roads of the country should be defrayed out of the produce of general taxation.

The Departmental Committee on Local Taxation recommended that a grant of one-half of the cost of maintenance and minor works of improvement of all main—*i.e.*, first-class—roads should be made to the local authority financially responsible.

This proportion has been generally recognised as fair for the majority of the first-class roads, but it is frequently suggested that certain of these, which might be called "trunk roads," should receive a more liberal contribution from the State—say 75 per cent of the cost. If the total amount of the State grant is fixed, and the only question is one of distribution, it will probably be fairer all round to have as extensive a mileage as possible of first-class roads, on which the State pays one-half the cost, than a less mileage of these and an additional limited class receiving 75 per cent. If, however, the total amount of the grant for roads is not considered as limited, there certainly seems to be a case for a larger contribution from the State than one-half the cost in respect of certain great national thoroughfares.

Taking the mileage and cost of first-class roads as the same as that of main roads for the year 1912-13, the total State contribution, putting it at one-half the cost, amounts to £1,756,004. The grant proposed by the Departmental Committee for this class of roads was £1,600,000.

If the principle of 75 per cent for "trunk roads" be adopted, and we reckon, roughly, that this should apply to some 2,500 miles of road outside the county boroughs, the cost to the Exchequer of these would amount to £241,875, and that of the remaining first-class roads to £1,594,754, making a total for all first-class roads of £1,836,629.

The County Councils Association, taking the recommendations of the Departmental Committee as a basis, made the following suggestions as to certain details relating to grants for first-class roads:—

(1) That half of the approved annual expenditure (including any annual charge in respect of loans) on maintenance of all first-class roads should be paid by the Exchequer and half by the county council, but the county council should not be liable to pay half the cost in the case of a borough or district road unless the county surveyor has certified that it has been efficiently maintained.

(2) That the county council should have power to contribute to the expenditure of any first-class borough or district road in addition to the half cost of maintenance.

As Sir George Gibb has pointed out, the case of London and the county boroughs stands on an entirely different footing from that of the administrative counties.

"None of the factors," he says, "on which reliance is placed in order to establish that road maintenance is a national service are present in the case of county borough roads. The traffic using these roads is preponderantly local or regional, and the standard of maintenance required is not raised or materially affected by the small percentage of through traffic which may use some of the roads. The total burden of maintenance cost in the year 1909 amounted, in county boroughs, to 5·5d. per £ of assessable value, and 27·3d. per head of population, the corresponding figures for metropolitan boroughs being 4·22d. and 36·7d. These figures contrast with an expenditure in the administrative counties of 14·2d. and 72·4d. respectively, or, after deduction of the Exchequer contributions to main roads, 11·2d. and 57d. Measuring the burden, therefore, by its ratio to assessable value, it is much less in county and metropolitan boroughs than in the administrative counties, and it cannot be said in the former case, as it can in respect of some roads in the latter case, that the burden is materially affected by through traffic."

Sir George Gibb's conclusion as to the manner of classifying county borough roads for the purposes of grant was as follows:—

"Perhaps, on the whole, the best conclusion on this matter would be that county boroughs should be left to bear the comparatively slight burden which the maintenance of roads throws upon them, and that any relief to their local taxation should be given under other heads of expenditure; but if it is thought desirable in principle that county boroughs should share in road maintenance grants, then the share should be fixed by one or other of the following methods:—

"(1) Roads to be selected and classified by central authority as subsidised main roads in county borough areas, and to receive subsidies calculated as near as practicable at the same rate per square yard on the selected roads as the average grant to subsidised main roads in the adjoining county or counties.

"(2) Grant a small annual percentage—say 5 to 10 per cent—of the total cost of maintaining all roads in county boroughs.

"(3) In lieu of grants to maintenance, grant a fixed annual sum, based on population to each county borough, to be spent either on the widening of roads

or the construction of new roads to relieve traffic congestion.

"It would probably be right to treat London in the same way as county boroughs."

The Departmental Committee adopted substantially the first of Sir George Gibb's alternatives, recommending that, in respect of those roads in London and the county boroughs which are included in the first class, Exchequer grant should be paid "at the average rate per mile for the main roads in the urban portions of the adjacent administrative county or counties." Reading this with the other recommendations, it appears to mean that the grant shall amount to one-half (and not the whole) of the cost of maintenance at the rate mentioned, but the point is not clear. Assuming that to be the case, and taking the Departmental Committee's proposed total grant for this purpose of £200,000, if the average rate be calculated (very roughly) at £300 per mile, this would allow for the classification in London and the county boroughs of about 1,300 miles of first-class roads.

The proposal by the Departmental Committee on Local Taxation that the State shall bear one-quarter of the cost of "county"—*i.e.*, second-class—roads is generally recognised as reasonable. The committee proposed that one-quarter of the cost of these roads should be borne by county funds, the remaining half being charged to the highway district responsible for maintaining the roads.

The County Councils Association have carried this proposal rather further. They suggest—

"(1) That the cost of maintenance of second-class roads should be paid in the case of borough or district roads (not vested in the county council) as to one-quarter by the Exchequer, one-quarter by the county council, and one-half by the borough or district council, subject to provisions as regards efficient maintenance as in the case of first-class roads, and in the case of county roads (vested in the county council), as to one-quarter by the Exchequer and three-quarters by the county council.

"(2) That the county council should have power to contribute to the expenditure which they may approve on any second-class road, in addition to their legal liability."

This arrangement would make it an advantage to any one borough or district council to surrender its second-class roads to the county council. What would be the financial effect if a county council were to take over the whole of the second-class roads in the county would naturally vary considerably in different localities.

The third-class roads, so far as they are left under the control of the district councils, will, by general agreement, be maintained entirely at the cost of these bodies. The County Councils Association have made the following suggestions on this class:—

"That the borough or district councils should be solely responsible for the third-class roads within their area, and such roads should be, for all highway purposes, vested in them, provided that they should have power by agreement to contract with the county council for their maintenance, provided also that a county council should have power to claim to retain any third-class roads which were main roads before the passing of the Act, and that a borough or district council should have power by agreement to surrender to the county council any third-class road within their area, and that in any such case the county council should be responsible for the entire cost of such roads, and the roads should be vested in the county council."

If the county councils were to be made the authorities for all roads in their areas, other than in the boroughs and urban districts, the question would then arise whether, in respect of any of the roads, they should be able to make the cost a special charge on a particular area.

There would certainly be no question of this as regards first-class roads, and the County Councils Association's suggestions with regard to second-class roads seem to show that that association, at any rate, would be in favour of throwing the entire cost of these roads (other than the quarter contributed by the State) on the general county fund.

It would no doubt be considered equitable, however, that the third-class roads should be treated differently, and probably the district area would be considered the most convenient upon which to charge either the whole or a substantial part of the cost of such roads.

If the district council were to be selected as the unit of highway administration, presumably the State and the county would share the cost of the first-class roads, and the State and the district the cost of the second and third classes, unless the county council chose to contribute to the cost of either of these.

The total cost of maintenance of roads in England and Wales for the year ended March 31, 1913, was as follows:—

	Mileage.	Cost.*
		£
Main roads (urban)	4,338	1,023,266
Main roads (rural)	23,684	2,486,742
Boroughs (other than main roads) ...	4,955	551,155
Urban districts (ditto)	11,741	1,025,639
Rural districts (ditto)	94,936	2,405,120
County boroughs	10,056	1,433,958
London ,, ...	2,210	833,460
	151,920	9,761,340

If the proposals in the first part of this paper are acted upon, and the system of highway administration is in no way altered, the proportions of cost payable by the State and the various local authorities respectively will be as follows:—

Administrative Counties.

—	State.		C.C.		Boro' or D.C.	
	£	Per cent	£	Per cent	£	Per cent
Trunk roads ...	241,875	75	80,625	25	—	—
First-class roads ...	1,594,754	50	1,594,754	50	—	—
Second ,, ,, ...	600,000	25	600,000	25	1,200,000	50
Third ,, ,, ...	—	—	—	—	1,581,914	100
	2,436,629	32·5	2,275,379	30·3	2,781,914	37·1

If the trunk road proposal is not adopted, the result will be as follows:—

—	State.		C.C.		Boro' or D.C.	
	£	Per cent	£	Per cent	£	Per cent
First-class roads ...	1,756,004	50	1,756,004	50	—	—
Second ,, ,, ...	600,000	25	600,000	25	1,200,000	50
Third ,, ,, ...	—	—	—	—	1,581,914	100
	2,366,004	31·4	2,356,004	31·4	2,781,914	37·1

In neither case is any attempt made to allow for second or third class roads which might be taken over by the county councils.

London and County Boroughs.

—	State		C.C. or C.B.	
	£	Per cent	£	Per cent
First-class roads	200,000	50	200,000	50
Second or third class roads	—	—	1,867,418	100
	200,000	6·9	2,067,418	93·1

CONCLUSION.

The subject of this paper might, I am only too well aware, be treated with a far greater thoroughness and a far greater knowledge than I can pretend to. All I have attempted to do, on the instructions of the committee of the County Councils Association, has been to set down certain general considerations, and to put together a number of facts and opinions which may form a basis for discussion at the conference.

The financial aspect of the question has been so thoroughly dealt with by so great an expert as Sir George Gibb in his memorandum to the Departmental Committee on Local Taxation,† that everyone interested in the subject should study that as carefully as the report of the Departmental Committee itself.‡ Mr. Rees Jeffreys' General Report to the Third International Congress§ should also be read, both for its own sake and for the many useful appendices annexed to it.

* The figures given in col. 2 represent expenditure on maintenance only, and do not include improvements, scavenging and watering in towns, establishment charges or loan charges. The expenditure on these items exceeded £6,000,000, the total amounting to £15,868,750.

The amounts representing expenditure on maintenance of main roads is made up of (1) amounts expended by county councils on roads directly maintained through county surveyor's department; and (2) amounts expended by district councils on main roads. Payments by county councils to district councils in respect of maintenance of main roads have not been included, nor have the contributions of county councils to district councils for roads other than main, as these amounts would be included in expenditure by district councils.

† Appendix to the Final Report, Cd. 7316. Price 3s. 1d.

‡ Cd. 7315. Price 1s.

§ Obtainable from the secretary of the County Councils Association on the receipt of 4d. for postage.

I have quoted throughout this paper the resolutions of the County Councils Association, as they appeared relevant.

I would, however, repeat that these resolutions were intended merely to express the views of the association as to the best way in which the recommendations of the Departmental Committee could be carried out, no fresh suggestions being made except for the purpose of filling up one or two gaps in the scheme proposed by the committee.

It is not to be assumed from this that the association is satisfied that the Departmental Committee's scheme, even if the association's suggestions are incorporated, is a final solution of the questions of highway administration.

An opportunity is now given to a widely representative conference to consider whether something more complete might not be done. Some legislation will be necessary to carry into effect even the proposals of the Departmental Committee. Would it not be well, when the time comes for the introduction of such legislation, that the matter should be dealt with in a really comprehensive fashion, and that a complete system of highway organisation, suitable to the needs of modern traffic, should be brought into existence, and all the old complications and anomalies swept away ?

RURAL WATER SUPPLIES.

"ADMINISTRATIVE WASTAGE."

At a meeting of the Royal Sanitary Institute held at Yeovil on Wednesday of last week a paper entitled "Water Supplies to Rural and Small Urban Areas" was read by Dr. William G. Savage, county medical officer of health for Somerset.

The author said that with surface well supplies two distinct sources of pollution had to be guarded against—one the local contamination of the specific surface well, and the other the general contamination of the subsoil water. He considered that if all surface wells were properly lined, and made impervious to water for a depth of at least 12 ft., and were covered in to prevent pollution through the mouths of the wells, this would furnish a protection to the water quite sufficient for most country villages, unless the soil was very unsuitable for filtration purposes—an unlikely contingency. The general practice in rural districts was that the builder of the new cottage dug his surface well absolutely uncontrolled as to its position or structure. Very rarely indeed was a protecting area reserved round the well, nor for ordinary cottages would the well ever be found to be made impervious inside. Its position was often such that the contamination of its subsoil water was invited. Powers should be given, and all local authorities should be compelled to use them, to frame by-laws to the satisfaction of the Local Government Board dealing with the method of construction of surface wells and their position in regard to buildings, sanitary conveniences, and so forth. Should the absence of pure water cause disease, the damage and expense were not confined to the parish affected, but affected the whole rural district, and might extend to other parts of the country.

Dealing with the existing administrative wastage, Dr. Savage said the existing unsatisfactory arrangements and overlapping of authorities in regard to water supplies was an old story, but one which must be reiterated so long as they remain unremedied. Existing arrangements were chaotic, and not only a source of great waste of public money, but also caused many districts which under natural conditions were well supplied with water to be starved of this essential to healthy living. There was a considerable hampering of public work owing to water supplies being in private hands, and belonging to owners who would not yield a supply at all, or except under prohibitive terms, and this for water which they did not require and were never likely to need. Water companies often serve a useful function, and to enable them to exist their shareholders must have security and protection; but the health of a community was of paramount importance.

A clause was very badly needed to be added to every water Act giving the Local Government Board power, on complaint of county council or county borough, to exclude any district from their area of supply should such be found, after due investigation, to be required in the public interest. Clearly, there was need for co-ordination both in the interests of the health of the people, and to economise public money. A central administrative authority, as recommended by the Royal Commission on Sewage Disposal, was, he believed, necessary, working through county councils and other local bodies, while there was a very great deal to be said for the nationalisation of the water supplies of the country.

A SHEFFIELD IMPROVEMENT.

COVERING THE RIVER SHEAF.

The present attitude of the Treasury in the matter of loans required by municipal authorities to embark upon schemes of public work has had a far-reaching effect upon Sheffield. It has necessitated the keeping in abeyance of many extensive projects of great public utility. It is a matter for gratification, however (says a Sheffield contemporary), that at least a vital portion of one of the most important schemes of the corporation is to be carried to completion without delay.

This relates to the work of covering the river Sheaf from Exchange-street to the point where it runs into the river Don at Blonk-street, a distance of something like 120 yds.

The work has a bearing upon the contemplated new market scheme, and is part of the Exchange-street and Furnival-road widening operations. Although the project is one requiring considerable engineering skill, rigid economy is being exercised in its execution, and it is expected that it will be completed for an outlay of about £9,000.

The work was well in hand before the Treasury ban came into effect, and it was because of the progress that had already been made, and on account of the obstruction in the river and the interference with the waterway, due to the fixing of the contractors' plant and other things, that premission was given for the work to proceed. Matters are proceeding expeditiously, and the work, it is expected, will be finished within the next four months.

One of the most interesting features connected with the work is the diversion of the course of the river in order to preserve a uniformity of width. Whereas the river Sheaf, which is generally a sluggish stream, was originally from 50 ft. to a maximum of 70 ft. wide, its course has now been contracted to a uniform width of about 36 ft. The bridge in Exchange-street is to be widened from 40 ft. to 100 ft. by means of a brick arch, and at the other end a brick arch will be erected carrying the proposed new street, which is to be 60 ft. wide, extending from Blonk-street to Waingate, and absorbing part of the existing abattoirs, and running parallel to the river Don, over the river Sheaf. Between the two bridges the river is to be covered with reinforced concrete, and it will be possible to erect markets or any other buildings directly over the tunnelled watercourse.

A retaining wall will be constructed from the bridge at Blonk-street to the shambles, and there will also be a stone parapet facing the river Don, and running the entire length of the new street.

Already the arch over Exchange-street is well in hand, and the mass-concrete side walls for carrying the reinforced-concrete portion of the covering have been constructed, while the foundation for one of the abutments over the bridge which is to carry the proposed new street over the river has been put in.

The old weir has been removed, and a new one constructed, while the entrance to the old goit connected with Messrs. Turtons' Sheaf works has been modified. During the operations in this connection the water supply to Messrs. Turtons' works has been maintained without interruption. It is also proposed to divert the goit, which at present runs the whole length of Smithfield Market, along Furnival-road, thereby effecting a very desirable improvement.

The plans and particulars in connection with the scheme were prepared by Mr. C. F. Wike, the city engineer, and the work is being carried out under his supervision.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Limited. Price 10s. 6d.

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING IN LONDON—(5).

The first paper to receive attention on the opening of the second day's proceedings was one on

TRENCH OPENINGS AND REINSTATEMENTS,

by Mr. Reginald Brown, M.INST.C.E., M.I.MECH.E., F.S.I. The paper is reproduced on another page of this issue. Mr. H. T. Wakelam, M.INST.C.E., the president, again occupied the chair.

Mr. J. W. Horton (Derbyshire) remarked that the author laid stress on the advantage of inspection in connection with the reinstatement of trenches, and suggested that, given inspection when the trench was being refilled, the statutory time for repairs might be altogether abolished. His (the speaker's) experience was contrary to that. Everyone with experience of the difficulties of restoring trenches would know that the period of six months allowed by the Statute was absolutely insufficient, and that they could not afford to do away with a week of it. There ought to be no limit of time. He had found that companies who had employed contractors to do the work had discovered that it was absolutely impossible so to restore the trench that after six months it was equal to the road. He had himself, at the request of companies, tried to restore trenches in that period, but had found it absolutely impossible. In the case of a trench—not a deep one—which he had to restore the work became bad twelve months later, and he felt it was the experience of every engineer that one could not get a satisfactory reinstatement of trenches. It was not equitable that the highway authority should have to incur expense in order to increase the profits of any company, because that was what they did if they relaxed the power which Parliament had given them.

Mr. G. W. Lacey (Oswestry) said he felt a certain sense of disappointment with the paper. Mr. Brown was nothing if not original, and, though he was not dealing with a new subject, his remarks were somewhat original. Mr. Brown's term of "highway dermatology" did not fit the case quite, because it was more than a skin eruption—it disturbed the whole structure of the road. Though the term was not altogether inapt, it did, to his mind, slightly obscure what, if translated into road engineering phraseology, would not be called highway dermatology, but highway damnology. He offered that to Mr. Boulnois if he chose to adopt the term in his "Glossary." It was a very difficult subject indeed, and he agreed with what Mr. Horton said, that they could not get the majority of trenches back to their original condition in a space of six months, especially in the case of a longitudinal trench, which broke the shoulder of a road. That particularly applied to roads, of which they had many, with insufficient foundation, and, so far as he knew, there was no power to compel the authority or an individual to place a new foundation where that foundation did not exist. ("Question.") It might be a question, but he thought there would be a difficulty in enforcing it. He had a case of a gas trench which was replaced as well as one could expect, and, though it was rolled well, subsidences were still taking place after a period of two years. But they were indebted to Mr. Brown for many of his suggestions, which would no doubt help to remove some of the present difficulties.

Mr. H. Gilbert Whyatt (Great Grimsby) said the report was highly interesting to him because he was preparing for a sub-committee a report on the question of reinstatements. He did not quite agree with the period of reinstatement for which companies were to be liable. He found from the Gas and Water Works Clauses Acts they were liable to maintain them for twelve and not six months, and he thought that, with the exception of the Post Office, twelve months was the term; but even twelve months was sometimes far too short, for he had found that sixteen months after a reinstatement had taken place a quick subsidence had occurred. It might be quite sound at the end of twelve months, and at sixteen months it seemed to crystallise and subside very quickly. He found also that where one of the undertakers carried out the work with a sub-contractor—especially with a tar-paved footpath—the tar-paving lasted only about eighteen months altogether. They just catered for a specification of tar-paving which would last fully twelve months. The difficulty seemed to be that a local authority had no option with regard to the maintenance, although they could make it very awkward for the company by compelling them to deposit the specification and plan three days before the opening was made. If they made a schedule of prices applying to small openings, it was far too costly for large openings, and in the report he was preparing he was going to suggest a scale of charges for small and large openings and long trenches. The paper was highly interesting and exceedingly valuable, but Mr. Brown had given no indication as to what sort of mechanical rammer would be suitable for all sorts of trenches, or whether he proposed to have three, four or six on each job.

Mr. H. F. Gullan (Belfast) said he was quite convinced it was quite impossible to restore trenches of all kinds by mechanical means and have no settlement. They might be able to do it with a gravel subsoil, but with stiff clay or boulders it was quite impossible. There were certain conditions of subsoil that could be rammed solid, but by no means all. It might interest to know what they had done in Belfast. There the gas, water and electric light all belonged to the municipality, and the committees had all agreed that the Works Committee should make the final restoration. The actual charges were levied for the work, and the surface had to be maintained for twelve months at the expense of the parties opening. That ensured a good, sound job, care being at the same time exercised that the department responsible for an opening was not overcharged. A plumber, before making and opening, was obliged to take out a licence—a document which had to be signed by the contractor, and on which there were fifteen conditions as to the way in which the work was to be done. At the same time, the contractor made a monetary deposit, which was returned to him as soon as the work was completed to the satisfaction of the corporation. If he made a connection with the main sewer that had to be done under the supervision of an inspector. He had also attached a slip—which could be torn off—authorising the authority to make good the openings at the contractor's expense. Practically all these openings were being made good in that way. The difficulty had been to get openings properly made good, and the contractors had found the best and simplest way was to get the corporation to do the work. They had found it more economical, and the work was done to the corporation's satisfaction. Postal and telegraph openings were mostly done by the contractors for the Post Office. Until recently they operated in the same way by taking out a licence, and the deposit was according to the extent of the openings they had to make. At the present time they were faced with 7 or 8 miles of openings, and recently a contract was made for 2 miles of openings, where they were laying telephone wires under the streets. They issued a schedule of prices to contractors. The Post Office had accepted that, and the work was being done on it, with a charge for supervision, as was done with the telephone company when they were in existence.

Alderman Hitchcock (Taunton) said he considered there was nothing better than manual labour for this class of work, if they employed their own men. Companies should have the right to open roads after notice, but it should be the duty of the authority to fill in the trenches.

Mr. W. Harpur (Cardiff) said his contention was that when once they opened a road for these trenches they could not possibly put back all the material into the trench and ram it into the same consistency as mother earth. He could give instances of road surfaces opened up for works of one kind or the other where trenches, made as long ago as twenty or thirty years, were still of a different consistency from the earth surrounding them. Weather conditions had a good deal to do with the restoration of a trench. He could give them an illustration of a trench with a fairly hard substratum which was opened two years ago, and in which, although it was restored as carefully as possible, they could still see depressions and undulations. He could not suggest a reason for these evils, but Mr. Brown's paper illustrated, to a very large extent, the reason for these corrugations in road surfaces. They could see, when a road surface was cut up in that way, how very little of the original

the ace was left, and how these soft places contributed to corrugations in the road surface.

Mr. J. DIGGLE (Holywood) stated that the Post Office excavations had been small in his district. Where they commenced to make an excavation he got them to give him a promise to restore and maintain for twelve months. Some of these trenches had subsided within three months, and he had had to go to them again. With respect to the reinstatement of gas and water trenches, he made a point of sending his order for the reinstatement at their expense. They used to have a system of charging 1s. per yard. They found that was not sufficient where they had a small trench of two or three yards, but if they had a large trench it paid. He thought it fairer to make a charge for the actual cost of the work.

Mr. J. W. COCKRILL (Great Yarmouth) agreed that the filling of a trench was greatly improved by adding water where they had a sandy subsoil to deal with. But if they tried it on a clay subsoil they would probably have to take the soil out of the trench again. The Post Office had recently relaid the whole of their mains underground in Yarmouth, and the corporation insisted upon the openings being restored by the corporation workmen at the actual cost plus 7½ per cent for administration and supervision. The Post Office were now asking the corporation to do it at cost without allowing anything for supervision.

Mr. BROWN, in replying, said he was not going to deal with the speakers ad lib. It was no use trying to write a paper with which every surveyor agreed. He would ask if the matter was of sufficient importance for the council to make suggestions to districts as to some definite specification to be followed by those who opened the roads. Some years ago he wrote a paper on artificial stone, and he suggested that a specification should be drafted. The council took up the matter, and issued a draft specification. He thought this matter was quite as important as artificial stone making. He did not think the period mattered much. His view was that they should relieve the companies entirely from maintenance.

(To be continued.)

A Glossary of Road Terms. By H. Percy Boulnois, M.INST.C.E. St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, E.C. Price 2s.—Mr. Boulnois has achieved far more than he may imagine by this production of his pen. He set out to standardise the nomenclature of road terms; in addition he had made a valuable addition to English literature. To the untutored it is like reading a new language; Mr. Boulnois says it isn't anything like "complete." At any rate, it is a valuable *vade mecum* which no one has attempted before.—*Portsmouth Times.*

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

INSPECTOR.—July 24th.—Nantwich Urban District Council. £100—£120.—A. E. Whittingham, clerk, 7 Mill-street, Nantwich.

ASSISTANT INSPECTOR.—July 24th.—Northwood Urban District Council. £120 per annum.—Mr. E. R. Abbott, Council Offices.

ROAD FOREMAN.—July 24th.—Penge Urban District Council. £2 per week, with free living quarters.—Mr. H. W. Longdin, surveyor, Town Hall.

SURVEYOR AND INSPECTOR.—July 27th.—Llandrindod Wells Urban District Council. £140 a year.—Mr. D. C. Davies, clerk, Town Hall, Llandrindod Wells.

SURVEYOR.—July 28th.—East Kerrier Rural District council. £80—£100 a year.—Mr. H. Truscott, clerk.

INSPECTOR OF NUISANCES.—August 3rd.—Holsworthy Rural District Council. £90 per annum.—Mr. C. Kinsman, clerk, Holsworthy, Devon.

HIGHWAY SURVEYOR. — August 4th.—Eastbourne Rural District Council. £200 per annum.—Mr. T. E. Varley Kirtlan, clerk, 92 Terminus-road, Eastbourne.

ASSISTANT.—Wakefield Town Council.—Waterworks Engineer, Town Hall, Wakefield.

CLERK.—Dorset County Council.—Mr. E. Archdall Ffooks, clerk of County Offices, Dorchester.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

FINCHLEY.—July 26th.—For the internal decorations of workmen's dwellings, for the urban district council.—Mr. C. J. Jenkin, engineer and surveyor.

WILTS.—July 26th.—For the erection of sanatoria, for the county council.—County Surveyor, Trowbridge.

KENT.—July 26th.—For the execution of summer repairs to school, for the Education Committee.—Mr. W. H. Robinson, architect, Sessions House, Maidstone.

ROCHESTER.—July 27th.—For the enclosure and conversion of a railway arch for use as a fire-engine house, for the corporation.—City Surveyor, Guildhall.

WALSALL.—July 27th.—For alterations to substations, for the corporation.—Borough Electrical Engineer, Wolverhampton-street, Walsall.

HOLLAND (Lincs).—July 27th.—For alterations at a school, for the Education Committee.—Mr. E. J. A. Christie, county architect, Sessions House, Boston.

SOMERSET.—July 28th.—For the rebuilding of Ham Bridge, consisting of the taking down of the existing bridge and erecting a new bridge with reinforced concrete, for the county council.—Mr. Edward Stead, county surveyor, County Council Offices, Wells.

SHEFFIELD.—July 30th.—For the erection of a pump-room at generating station, for the corporation.—Electricity Offices, Commercial-street, Sheffield.

WOLVERHAMPTON.—July 31st—August 16th.—For foundations for cooling tower, and for a pumphouse building at electricity works, for the corporation.—Mr. S. T. Allen, engineer, Electricity Works, Commercial-road.

GLASGOW.—August 2nd.—For additions to Allan Glen's school, for the School Board. Mr. J. Clark, clerk, 129 Bath-street, Glasgow.

RAWTENSTALL.—August 5th.—For the erection of a workshop, for the corporation.—Mr. J. Johnson, borough surveyor.

DUNDEE.—August 7th.—For the construction of the columns, beams and floors forming the reinforced-concrete framework of the superstructure of the city hall, for the corporation.—City Architect, City Hall.

WOKING.—August 9th.—For the construction of a bridge over the Basingstoke Canal, for the urban district council.—Mr. G. J. Wooldridge, engineer and surveyor.

MERTHYR.—August 9th.—For the erection of 160 workmen's dwellings, for the corporation.—Borough Architect, Town Hall.

Engineering: Iron and Steel.

ROTHERHAM.—July 24th.—For the supply of smudge and pea nuts, cable, and meters, for the electricity department.—Engineer and Manager, Electricity Works.

MERTHYR.—July 26th.—For the supply of steel and cast-iron pipes, and for laying 3½ miles of pipe lines, for the corporation.—Sir Alex. Binnie, Son & Deacon, St. Stephen's House, Victoria Embankment, S.W.

DUBLIN.—July 26th.—For the supply of electricity cables and other works, for the corporation.—City Electrical Engineer.

GUILDFORD.—July 27th.—For the removal of old bridge and the construction of a new bridge, for the rural district council.—Mr. J. Anstee, engineer, Council Offices, Commercial-road.

SOMERSET.—July 28th.—For rebuilding a bridge, for the county council.—County Surveyor, Wells.

LEICESTER.—July 29th.—For the disposal of about 45 tons of mostly old 24-in. diameter cast-iron pipes, and two lengths of 18-in. wrought-iron or steel riveted tubes and special castings.—Mr. E. George Mawbey, borough engineer.

SHEFFIELD.—July 30th.—For water service conduit, screen chamber, penstocks, valves, and piping, for the Electric Supply Committee.—Mr. S. E. Fedden, manager and engineer, Commercial-street.

DARLINGTON.—July 31st.—For the supply of a 3-ton or 5-ton motor lorry, for the corporation.—Mr. C. Winter, borough surveyor.

ALTON.—August 4th.—For steel girders and steel trough flooring for a bridge of 15 ft. clear span, for the rural district council.—Mr. C. W. Maudsley, surveyor, Park Close-road, Alton, Hants.

MIDDLESBROUGH.—August 6th.—For the construction of a timber jetty, for the Port Sanitary Authority.—Mr. I. C. Barling, Royal Exchange, Middlesbrough.

RANGOON.—August 11th.—For the installation of a system of fire alarms, for the municipality.—Messrs. Ogilvy, Gillanders & Co., 67 Cornhill, London, E.C.

RICHMOND, N.S.W.—September 6th.—For the supply and erection of two units, each consisting of a centrifugal pump and electric motor, for the Metropolitan Board of Water Supply and Sewerage, Sydney.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Gas and Electricity.

AYLESBURY.—July 28th.—For supplying and fixing electric motor and pump, for the urban district council.—Mr. W. H. Taylor, engineer and surveyor.

Roads.

LITTLE LEVER.—July 24th.—For the supply of road materials and labour, for the urban district council.—Mr. J. Seddon, surveyor.

RUISLIP-NORTHWOOD.—July 24th.—For the supply of 522 tons of bituminous granite, 217 yds. of hand-picked hardcore, and 330 tons of broken granite, for the urban district council.—Mr. Edmund R. Abbott, clerk, Council Offices, Northwood, Middlesex.

WESTHAMPNETT.—July 26th.—For steam rolling during the year, for the rural district council.—Mr. W. D. Rasell, clerk, 5 South-street, Chichester.

DOVER.—July 26th.—For the supply of Guernsey granite, Guernsey chippings, and Guernsey siftings, for the corporation.—Mr. R. E. Knocker, town clerk.

ROWLEY REGIS.—July 26th.—For raising a highway and constructing sewers, for the urban district council.—The Surveyor.

SCUNTHORPE.—July 26th.—For the supply of any quantity up to 400 tons of broken granite of approved quality, for the urban district council.—Mr. Herbert Heap, engineer and surveyor.

HIPPERHOLME.—July 26th.—For the supply of broken granite, chippings, and tarred road materials, for the urban district council.—Mr. G. W. Thompson, engineer and surveyor.

GLASGOW.—July 27th.—For constructing roads and drains, for the corporation.—Office of Public Works, 60 Cochrane-street.

SOYLAND.—July 27th.—For taking up and relaying 800 yds. super. of setts, for the urban district council.—The Surveyor.

CARDIFF.—July 29th.—For the execution of street improvement works, for the corporation.—City Engineer.

TISBURY.—August 3rd.—For the hire of steam roller, for the rural district council.—Mr. E. Plummer Davies, surveyor.

BRAINTREE.—August 4th.—For the supply of 700 to 1,000 tons of broken granite, for the urban district council.—Mr. H. H. Nankivell, surveyor, Vestry Hall.

ALVESTON.—August 7th.—For the supply of tarred slag and tarred limestone, for the urban district council.—Mr. W. J. Holbrooke, clerk.

Sanitary.

ROMFORD.—July 24th.—For the construction of manholes, for the urban district council.—Mr. T. H. Ridge, surveyor.

HAMILTON.—July 26th.—For the supply and installation of sanitary fittings and laundry and washhouse plant, for the Middle Ward District Committee.—Messrs. Sydney Mitchell & Wilson, architects, 13 Young-street, Edinburgh.

TIVERTON.—July 27th.—For laying stoneware pipe sewer with manholes, for the rural district council.—Mr. R. Ellis, sanitary inspector.

MELTON MOWBRAY.—July 27th.—For the construction of sewers and manholes, for the rural district council.—The Surveyor.

CANNOCK.—July 28th.—For the provision, laying and jointing of about 56 yds. of 9-in. pipes and 272 yds. of 9-in. stoneware sewers, and other incidental works, for the urban district council.—Mr. R. Blanchard, engineer and surveyor, Council Offices, Cannock.

MERTHYR.—July 31st.—For the supply of horses and drivers for scavenging work, for the corporation.—Medical Officer of Health, Town Hall.

WARRINGTON.—August 3rd.—For the removal of the contents of pails and ashtubs, for the rural district council.—Mr. F. W. Kerfoot, inspector, Bewsey Chambers, Warrington.

EAST GRINSTEAD.—August 4th.—For laying 300 yards of stoneware sewer and the construction of manholes, for the rural district council.—Mr. C. Turton, engineer and surveyor, 6 High-street, East Grinstead.

ASHBY WOULDS.—August 14th.—For laying cast-iron and stoneware pipe sewers, and constructing manholes, for the urban district council.—Mr. H. Walker, consulting engineer, 408 Mansfield-road, Nottingham.

BUNGAY.—August 16th.—For house scavenging, for the urban district council.—Mr. P. J. Sprake, clerk.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.
‡ Provisionally accepted.

ELY.—For the building of an isolation hospital, for the urban and rural district council.—Mr. S. J. Wearing, architect, Norwich:—

H. Rooke & Sons, Cambridge	£3,493
Kidman & Sons, Cambridge	3,483
Thornhill Brothers, Lincoln	3,338
E. J. Smith, Bunwell	3,335
F. Tucker, Ely	3,266
Parren & Son, Earith, Hunts	3,228
R. Shanks, Chatteris	3,208
Tash & Langley, King's Lynn	2,955

GELLYGAER.—For kerb, channel, and drainage works, for the urban district council.—Mr. F. Read, surveyor, Hengoed, Glam.:—

F. Hayes, Liverpool	£204
A. Warne, Abertysswg	178
F. & R. Lewis, Gilfach	175
W. Jones, Llanbradach	147
G. P. Trentham, Limited, Birmingham	146
H. Protheroe, Merthyr Tydfil	135
Blackburn & Evans, Troedyrhiw	129
J. Lawrence, Bargoed	127
J. P. Packer, Ystrad Mynach	121

TOTNES.—For laying 3-in. cast-iron water main, for the rural district council.—Mr. W. J. Goode, surveyor, Buckfastleigh:—

Steer & Pearce, Plymouth, £311.

UCKFIELD.—For the supply of road materials, for the urban district council:—

Scotch Granite.—Hudsons, Limited, 1,000 tons at 16s. 8d. per ton.

Mountsorrel Granite.—Mountsorrel Granite Company, 1,000 tons at 16s. 6d. per ton.*

Croft, Leicestershire Granite.—C. H. Robchenowe, 1,000 tons at 16s. 5d. per ton.

WALTHAMSTOW.—For exterior painting to various schools, for the Education Committee.—Mr. H. Prosser, Architect and Surveyor to the Education Committee:—

Queen's-road School.

J. Sands, Walthamstow	£190
D. W. Lucas, Walthamstow	188
A. H. Inns, London, E.C.	154
A. G. Barton, Walthamstow	148
F. E. McBride, Walthamstow	142
A. J. Wick, Walthamstow	138
J. S. Fenn, Woolwich	119
J. J. Woollaston, London, W.C.	118

Blackhorse-road Schools.

D. W. Lucas, Walthamstow	£194
A. G. Barton, Walthamstow	165
A. H. Inns, London, E.C.	163
A. Tranter, Tottenham	143
J. J. Woollaston, London, W.C.	139
F. E. McBride, Walthamstow	138
A. J. Wick, Walthamstow	131
J. S. Fenn, Woolwich	129

Edinburgh-road School.

D. W. Lucas, Walthamstow	£55
F. E. McBride, Walthamstow	49
J. S. Fenn, Woolwich	47
A. H. Inns, London, E.C.	46
J. Sands, Walthamstow	41
A. G. Barton, Walthamstow	39
A. J. Wick, Walthamstow	38
J. J. Woollaston, London, W.C.	36

The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

Sewage Purification by Forced Aeration.

The paper of Mr. J. P. Wakeford, M.INST.C.E., on his experiments at Wakefield was very useful, on the occasion of the recent annual meeting of the Institution of Municipal and County Engineers, in focussing attention on the latest phase of the sewage problem. As the author remarked, the purification of sewage by forced aëration is by no means new. Over twenty years ago Lowcock and Waring carried out a number of experiments by forcing air into the filters; but it is only recently that aëration has been tried in conjunction with "activated sludge." The slimy film on the top of the filter has long been looked upon as the chief source of the purification both of water and sewage. It is well known that water engineers do not attempt to use a filter immediately after it has been cleaned, but that they run to waste a certain amount of water until the surface film, which contains the purifying bacteria, is formed. The new method seeks to dispense with filtering materials by converting sewage sludge into "activated sludge" by forced aëration. It is claimed to be a speeding up of biological methods, and is not applicable to sterile sewage and sterile sludge. Mr. Wakeford found that with thoroughly activated sludge it was possible completely to oxidise the ammonia present after two hours' aëration. With an average aëration of two hours the purification by the oxygen absorption and albuminoid ammonia tests was equal to that by chemical precipitation and bacterial filters. Oxidation is influenced greatly by temperature, and the sewage is much more rapidly clarified in summer than in winter. The results now obtained are fairly satisfactory, but with an improved method of diffusing the air these can certainly be expected to improve. Unequal porosity of the tiles and uneven diffusion of the air are the chief defects with the present forms of false floors. Whether a continuous flow or "fill and draw" method is best is a matter for further investigation. The experience with contact beds and percolating filters should be useful in deciding this point. There are other matters requiring careful attention with this system. The activated sludge contains a large percentage of moisture, and it will therefore be more costly to press, but it is claimed that it has a high manurial value. With a much higher percentage of purification in the tanks the effluent could be passed through filters at a much higher rate, and thus reduce the area of the filters, where their use was found necessary. In addition to quicker purification, increased fertilising value, and the saving in filters, it is claimed that there is less putrefaction and offensive smells, and reduced capital cost and maintenance charges for the outfall works.

In the discussion on Mr. Wakeford's paper several of these conclusions were challenged. While the system was thought a step in the right direction, it was considered by several speakers a debatable point whether the smell would be less or capital costs and maintenance be reduced. It was recognised that different sewages required different treatment, and that even in the same town the sewage varies in strength and volume each hour of the day. Temperature plays such an important part in the purification that the question of open or closed tanks will have to be considered. Attention was called to the fact that 25 per cent sludge capacity was required in the tanks, that no satisfactory method of diffusion was known, and that the tremendous amount of air required was a costly item. As the rate of purification in the tanks fell rapidly after the first hour, it was suggested that one hour's aëration would be sufficient, and that the filters could do the rest more cheaply. Again, it was said that to work this system successfully it would be necessary for every engineer to have a qualified chemist on his staff. Mr. Watson, whose large experience entitles him to be heard with respect, was of opinion that Mr. Wakeford would have to modify many of his conclusions. Though the process was a natural one, Nature was being forced into methods which interfered with its simplicity. Novel or exceptional methods should be eliminated. Difficulty would be experienced in many towns with the acids in the sewage, which are in some cases so strong as to destroy the impellers of centrifugal pumps in five months. The discharge from gas plants or residuals destroyed all organisms for a time. The pressure at which the air is supplied and the volume per gallon of sewage is a matter for experiment in each town. Mr. Martin at Salford finds the time vary from one to twelve hours according to the condition of the sewage. He also finds difficulty in gauging the quantity of air supplied, as no reliable air meter appears to be on the market. He has not yet been able to find a diffuser which will hold the sewage up and let air go through without the openings getting choked. The discussion of this question again calls attention to the importance of the engineer in settling the sewage problem. Collaboration between the chemist or bacteriologist and the engineer is necessary, for when principles have to be put into a practical form

it is the engineer who is called on to solve the difficulty.

British Fire Prevention Committee's War Emergency Work.

One of the characteristic features of the war in which the country has been engaged for the past twelve months is the liability to which we have been subject of attacks by hostile aircraft. Moreover, the risk from this source has by no means been limited to loss of life and damage to property by explosions, but the use of the incendiary bomb has enormously increased the possibility of serious outbreaks of fire. Special steps have been taken to meet this risk, and it is not surprising to find that considerable assistance in this direction has been rendered to the authorities by the British Fire Prevention Committee. Among the special features of this war emergency work dealt with by the committee during the first year of the war may be mentioned the establishment of a Fire Survey Force. At the outbreak of war the committee formed a Special Force of 100 surveyors to undertake at short notice any fire surveys required by the Government in an honorary capacity. Over 900 establishments taken over for war emergency work all over the country were surveyed. Latterly re-surveys have been made in cases of special fire risk. The committee also established a Warning Service embracing the preparation and free issue of a large number of public "fire warnings" in connection with the war emergency disseminated by the committee in the form of posters, circular letters, or as notices. The special classes of risk under review, for which special notices were issued, included hospitals, convalescent homes, refugee hostels, schools, billets, factories, and farms, for each of which a separate form of warning was prepared, whilst aircraft hazards were dealt with on general lines. The total issue of posters and so forth exceeds 200,000. The issue of these posters involved a careful distribution with directions, and arrangements were also made for various organisations and societies to reproduce those that concerned their members; moreover, the majority of the "warnings" were reproduced from time to time in the daily and technical press. Another work undertaken by the committee was the organisation of a special fire service force at the outbreak of the war, comprising ex-fire brigade officers and foremen. This was originally brought into such a form as to make 300 firemen readily available for mobilisation in sections within forty-eight hours.

The whole of the complex work arising out of these services has been carried out by a Headquarters Sub-committee, loyally assisted by the clerical staff of the committee, and in its operations the committee invariably kept in close touch with the Government Departments and other central authorities concerned. The work of the committee has been cordially received, and its Technical Enquiry Office in particular was largely used by the public. The results of the work have been far reaching. The great care taken by the public on simple, sensible, and inexpensive lines to prevent outbreaks of fires and to meet them with organised self-help is extraordinary, and must affect the reduction of the fire loss after the war as it has during the war. The fire loss during the war has been substantially reduced, the number and extent of the fires being materially less. Although there may have been fires in certain classes of factories and stores, due either to pressure of work, inexperienced personnel, or possible incendiarism, the work of the committee has, on the whole, been most effective in preventing loss of life from fire, in the conservation of property, and in reducing the inconvenience caused by fires in war time. Indications of the appreciation of these results have not been lacking, and the British Fire Prevention Committee has once mere earned the thanks of the public for its work on their behalf.

Battery Trams.

The Corporation of Morecambe bid fair to become the pioneers in this country of the system of battery-driven tramcars. The tramway service of the town has been worked by animal traction for many years past with considerable success, but in these days it has become almost a matter of necessity seriously to discuss the adoption of electricity as a motive power. In doing so the corporation at once found themselves in a difficulty owing to the peculiar circumstances of the town and district, which are such as virtually to preclude the adoption of either the conduit or trolley systems. As regards the former there is at Morecambe not only the usual objection on the score of expense, but the further very practical difficulty of the possible interference of the service by the incursion of the sea. On the other hand, it is felt that the adoption of the overhead system would be prejudicial to the best interests of the town, owing to its effect upon the scenery of the neighbourhood. We do not here intend to enter into any discussion as to the validity of the last-named objection. Suffice it to say that it appears cogent to the authority upon the spot, and that it has led to the consideration of a scheme for replacing the existing horse-drawn vehicles by battery-driven cars. The system has already been adopted in some towns in America, but the Morecambe scheme is of peculiar interest, inasmuch as if it matures it will be the first of its kind in this country. The necessary capital expenditure is stated to be about £18,000 to cover the provision of twelve double-deck cars together with a depot and charging-station and the required extension of the mains, and the total running cost, including the repayment of this capital, is guaranteed not to exceed 5½d. per car mile. These details appear from a very interesting paper on the general subject of Battery Vehicles as an Adjunct to Tramways which was read by Mr. W. H. L. Watson at the recent annual meeting of the Tramways and Light Railways Association, and in which the very satisfactory results that have attended the establishment of battery omnibus routes in various towns were also considered. The latter vehicles are of special value in building up routes, prior to the extension of a full tramway service, as the installation is at once cheaper and of greater mobility. The comparatively low running cost is a large factor in favour of these vehicles, and again goes to show that the battery vehicle has a future before it. If the Morecambe corporation decide to embark upon their scheme, the result will be watched with great interest.

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The Partial Re-erection of Old Buildings.

The decision of the Court of Appeal in the case of *Rex* v. *Foots Cray Urban District Council, No. 2*, is of considerable importance both to local authorities and to property owners. Questions have frequently arisen, where alterations were being made to a building, as to whether the operations amounted to the erection of a new building, so as to necessitate the submission of plans to the local authority in compliance with the by-laws. In the case of *James* v. *Wyvill* it was held that it was a question of fact, in each individual instance, whether or not a new building was being erected. Sec. 23 of the Public Health Acts Amendment Act, 1907, however, provides that for the purposes of that Act and the Public Health Acts and any by-laws made thereunder the re-erection, wholly or partially, of any building of which an outer wall is pulled down to within ten feet of the surface shall be deemed the erection of a new building. In the Foots Cray case the appellants pulled down part of a very old inn, including certain outer walls, and gave notice to the council of their intention to erect a new part on the site of the part pulled down—such new part to fit into the old part which had been left standing—and they submitted plans of the new part only. The council contended that the

plans should have comprised the entire building, including the old part, and they refused to pass them. The appellants then obtained a rule *nisi* for a mandamus to the council to approve the plans, but the Divisional Court discharged the rule. From that decision the appellants appealed. The Court of Appeal overruled the Divisional Court and allowed the appeal, holding that the new part was the only new building being erected, and that the appellants had therefore complied with the by-laws. The rule for a mandamus was therefore made absolute. There will, we think, be many who will consider that there is a great deal to be said in favour of the view of the Divisional Court (thus overruled)—namely, that the whole building (*i.e.*, the old part plus the new part) should, under sec. 23 of the Act of 1907, be deemed to be a new building. However this view is of course no longer maintainable, and the decision will at all events relieve local authorities and their surveyors from the responsibility of attempting to discriminate in varying circumstances when old buildings are being partially re-erected.

* * *

Droitwich Rural Council and the Roads.

Zeal for economy in the upkeep of the roads, while praiseworthy in the abstract at the present juncture, may prove very ill-advised in practice, as the members of the Droitwich Rural District Council were forced to admit recently. Some time ago they adopted a resolution suspending "all work" on the roads for three months in order that the roadmen might work for the local farmers. The objective was an excellent one, but there was a lack of intelligent anticipation in foreseeing the consequences of such a far-reaching policy. The surveyor, in carrying out the resolution, stopped all contract work, and he explained that his justification for this was that in view of its terms he would have had trouble with the auditor if he had allowed any work at all. The result was, of course, just what might have been expected, if only the council had stopped to consider the real meaning of what they had done. Roads remained unattended after they had been seriously damaged by thunderstorms, and it was also found that the roadmen, instead of working for farmers, had obtained employment on the County Council roads, to their advantage in the material sense, as they received higher wages. The council, being made wise by the consequences of their ill-judged action, have now rescinded the resolution, but wisdom is tinged with the conviction that the passion for economy in the administration may be very easily misdirected and overdone. This passion, as appears from newspaper sources, has actually seized upon certain property owners in the Brigg district, who have written to the Local Government Board pointing out that the rural council propose to spend £1,700 in making up new streets "in face of the board's circular asking all public bodies to economise during the present crisis." A local councillor explains that this disinterested protest has reference to a locality where "last winter the roads were so bad that people were floating about on planks, in the absence of boats." This would seem to point conclusively to the necessity for the roads being constructed, and it is to be hoped that in spite of the prevailing desire for "economy" the board will, in the interests of public health, insist upon the recognition of this necessity in the only way possible.

* * *

Trade Effluents.

One of the most difficult problems in connection with the disposal of the sewage of a modern manufacturing district is that which arises from the presence of large quantities of waste products from the several industries that are carried on. It is true that some of these are comparatively harmless. On the other hand, some are of so deleterious a nature that our public health code contains special provisions limiting to a certain extent the duty of the local authority to receive and deal with them. They thus become a fruitful source of the pollution of streams. The difficulties which have been experienced in this country are now making themselves felt in the United States, and the whole subject is becoming increasingly important as the American people give themselves more to manufactures. In a recent issue of a New York contemporary it is pointed out that an illustration is offered by the Passaic river, in New Jersey. The several cities in the Passaic valley are spending millions of dollars in building an intercepting sewer along the river to prevent their sewage discharging into it. The river is lined with manufacturing establishments almost continuously throughout the length paralleled by the sewer, but comparatively few of these will be permitted to use the intercepting sewer and apparently they are making no provision for discontinuing their pollution of the river. But they discharge into it spent dyes from silk mills, foul liquors from chemical works, and other liquid and semi-liquid matters which are believed to be responsible for the largest part of the almost inky blackness of the river and for much, if not most, of the nauseating odours from it. So that the completion and use of the intercepting sewer will leave the river in almost as bad a condition as it is now, and worse than when the legislation for the construction of the sewer was first passed. It certainly appears from this that some further legislation is needed to enable local authorities to preserve the purity of the streams in their districts, and although our own system can hardly be described as perfect it might well be followed in its main outlines by our cousins in dealing with their own problem.

* * *

An Inverness Appointment.

At a special meeting of the Inverness Town Council last week one of the items on the agenda was the election of a burgh surveyor, and the circumstances attending the making of the appointment are so remarkable as to call for some comment. The Roads and Drainage Committee submitted to the council the names of seven candidates, four of whom were holding appointments in burgh surveyor offices, while two were architects and one was in the engineer's office of a railway company. Of the two architects, one was a local candidate, and it appears that for the past few years he has been on the staff of the Land Valuation Department and has carried out the valuation in the islands of the Outer Hebrides. It is perhaps hardly necessary to say that he was the successful candidate. It is a little difficult to see how an architect in practice is qualified to assume the duties of burgh surveyor, but when such a candidate has for some years been engaged in valuation work his appointment is little short of a public scandal. Why is it that local authorities continue to act in this way to the detriment of the public? In the case under discussion the successful candidate was a former member of the council—a fact which at once explains the action taken by that body in appointing him and adds to its impropriety.

London and the Road Board Grants.—In a report to the London County Council the Local Government Records and Museums Committee of that body state that they have had under consideration questions connected with the grants made by the Road Board to highway authorities. In the lists recently issued, arranged under the heading "County or county borough," has been included "London (area of) the Metropolitan Police district." There appeared, in the view of the committee, to be no justification for the inclusion of the Metropolitan Police district in a list purporting to comprise counties and county boroughs. They have informed the Road Board of this opinion, and have asked the board to consider whether any rearrangement can be made in future lists.

D

Brief Notes of Experiments in Sewage Purification by Forced Aëration.*

By J. P. WAKEFORD, M.Inst.C.E., City Engineer, Wakefield.

The purification of sewage by aëration is not new. Attempts at purification were made at a very early date by blowing air through the sewage, but the process was too slow to be of any practical use. An advance was made when Messrs. Clark, Gage and Adams, of the Lawrence experimental station, noticed that the process was considerably accelerated in the presence of certain green growths. The most recent investigations have been made by Dr. Gilbert Fowler and Messrs. Ardern and Lockett, of Manchester, who have shown that sewage can be purified within a reasonable time by blowing air through it in the presence of "activated sludge," hence the process is not new in principle, but its application in conjunction with the use of such sludge is a distinct advance on all previous efforts.

Before commencing experiments the author had, through the courtesy of Dr. Fowler, Messrs. Ardern and Lockett, and Mr. S. E. Melling, of Salford, seen certain experimental work carried out at the Manchester and Salford sewage works upon crude sewage in intimate contact with "activated sludge," and the results so impressed him that he decided to test its adaptability to the complex sewage at the City of Wakefield Calder Vale disposal works.

The system, stated briefly, is as follows:—

Sludge which has been brought into an activated state by thorough aëration is added to raw sewage, and the admixture is kept in a state of agitation by forcing air through it for a certain period. The air supply is then cut off, and when the solid matters in suspension are deposited, the supernatant liquor is in such a state of purification that it can be discharged direct to the river.

In a biological filter the period necessary for the filter to become "mature" is that period during which sewage sludge is deposited as a slimy film on

Description.	Oxygen absorbed in 4 hours at lab. Temperature.	Percentage purification on oxygen absorption figure.	Ammonia as N. Free and saline.	Ammonia as N. Albuminoid.	Nitrites (as N).	Nitrates (as N).
(a) Crude sewage, average	9·88	—	3·750	·780	—	—
After 6 hours' aeration	1·86	81·2	·480	·192	Nil	1·20
,, 24 ,, ,,	1·10	88·9	·999	·156	Nil	1·60
(b) Crude sewage	12·48	—	4·250	·800	—	—
After 1 hours' aeration	2·92	76·6	1·800	·328	Nil	·40
,, 6 ,, ,,	2·64	78·9	1·200	·248	Nil	·86
,, 12 ,, ,,	2·08	83·3	·300	·180	Nil	1·40
(c) Crude sewage ...	13·96	—	3·500	·750	—	—
After 2 hours' aëration	1·47	89·5	·700	·132	—	·50
,, 4 ,, ,,	1·28	90·8	Nil	·080	—	·90
(d) Crude sewage	16·44		2·750	1·140	-	—
After 1 hour's aeration	1·57	90·5	·100	·096	·10	·50
,, 2 ,, ,,	1·22	92·6	Nil	·076	Trace	·90
,, 3 ,, ,,	·91	94·3	—	—	—	—

the surface of the filter material to act as a nidus for the purifying organisms. During this period the slimy film is being converted into "activated sludge," which is the seat of the purification process.

The new process seeks to dispense with the filter material by converting sewage sludge directly into "activated sludge" by means of forced aëration. It is indeed a speeding-up of the processes which have been known for some time as biological methods of sewage purification, for it has been shown by Ardern and Lockett, and confirmed by the author, that the process is biological in that it cannot be carried out with sterile sewage and sterile sludge.

The experiments at the Wakefield works were first conducted in a 40-gallon cask in which a quantity of humus sludge was placed together with a quantity of ordinary sewage, and aëration was carried on for a few days. The sludge was allowed to settle for two hours and the effluent was drawn off. The barrel was again filled with crude sewage and aërated for twenty-four hours, the sludge allowed to settle for two hours, and the effluent drawn off. This was repeated four times, retaining the sludge in each case. It was noticed that the time required for each succeeding oxidation gradually diminished until eventually it was possible to obtain a well clarified effluent in two hours.

The foregoing table gives the results of the analyses of the four fillings.

It will be noticed that when the sludge had become thoroughly activated, as in case (*d*), it was possible to completely oxidise the ammonia present after two hours' aëration.

On the average, aëration for a period of two hours under the conditions of experiments, was sufficient to obtain a percentage purification as measured by the four hours' oxygen absorption and albuminoid ammonia tests, quite equal to that yielded by chemical precipitation and bacterial filters. The aëration was effected by means of a porous tile diffuser set in a light cast-iron box, an air chamber being formed between the underside of the tile and the floor of the box. This diffuser was placed on the bottom of the barrel to introduce the air in the finest possible state of division. The difference between aëration effected by air admitted in large bubbles and that in a fine state of diffusion is clearly seen in the following table, taken from Part II. of Messrs. Ardern and Lockett's Researches on the "Oxidation of Sewage without the Aid of Filters" ("Journal Society of Chemical Industry," vol. xxxiii.):—

Rate of Oxygenation of Raw Sewage. Results Expressed in Parts per 100,000.

Dilute Sewage.

Time.	Dissolved oxygen content when aëration effected by:— Plain tube.	Diffuser.
At commencement ..	·24	·24
After 15 minutes .	1·1	·73
,, 30 ,, ...	·49	·74
,, 45 ,, ...	·56	·76
,, 60 ,, ...	·75	·77
,, 90 ,,	·93	·79

Messrs. Ardern and Lockett have also proved that temperature influences the oxidation process, the sewage being clarified much more rapidly in the summer months than in the winter months. This can doubtless be overcome by using warm air when the temperature of the sewage is below normal.

In another series of experiments, samples of humus sludge contained in 80-oz. bottles were aërated for ten days, when the sludge had become thoroughly "activated." At the end of this time a sample of Wakefield raw sewage was aërated in contact with the "activated sludge," samples being taken every hour over a period of six hours. These results are shown in the following table:—

Experiments Carried Out in 80-oz. Bottles.

Results Expressed in Parts per 100,000.

—	4 hours' oxygen absorption.	Free and saline ammonia (as N).	Albuminoid ammonia (N).	Nitrites and nitrates (N).
Crude Sewage	8·44	4·429	1·371	·257
After 1 hr's. aëration	1·73	2·671	·543	·557
,, 2 hrs's. ,,	1·34	1·786	·100	·772
,, 3 ,, ,,	1·18	1·600	·371	·800
,, 4 ,, ,,	1·10	1·428	·314	·858
,, 5 ,, ,,	1·02	1·214	·257	·88
,, 6 ,, ,,	0·86	1·071	·200	1·000

Note.—The air being admitted by glass tubing, the results were not so satisfactory as those obtained where the air was diffused.

Following the results of the experiments in the barrel, it was next decided to test the process on a much larger scale, and a tank 30 ft. by 12 ft. by 6 ft. 6 in., has been installed, giving a capacity of about 11,000 gallons, exclusive of the "activated sludge." At the bottom of the tank ten sets of

* Paper presented at the recent annual meeting of the Institution of Municipal and County Engineers.

diffusers are fixed, four in each set, all connected to the main air delivery pipe. The air is forced through by means of an air compressor, consuming 90 cub. ft. of air per minute, at a pressure of 5 lb. per square inch.

A quantity of humus sludge, about 25 per cent of the total tank capacity, was placed in this tank which was afterwards filled up with a weak night sewage. After aërating for a few days the results obtained were not satisfactory. Samples were taken at different depths, when it was ascertained that the sample from the bottom contained a great deal more sludge than the sample at the top of the tank.

Since the main object to be aimed at is the intimate contact of air and sewage in the presence of "activated sludge" air to be in solution as much as possible—the arrangement in the tank is obviously wrong. The area of the tank is 360 sq. ft., and the area of the diffusers is 40 sq. ft., therefore the surface of the bottom of the tank through which the air is admitted is only about 11 per cent of the total floor area. The small bulk of sewage immediately above the diffusers is in rapid movement upwards, whilst 89 per cent, or the remainder of the tank, depends upon its supply of air and activated sludge by the falling backwards of the particles and by cross currents. It was found that the "activated sludge" which should, during blowing operations, have been in complete suspension and agitation, had deposited in banks on the spaces between the sets of diffusers. To obviate this difficulty the space between the diffusers was banked up in concrete in ridges about 18-in. high and by this means every particle of sludge was kept in motion and any solids falling on the ridges were carried by the water above on to the diffusers and forced up again by the air. This method proved satisfactory, the sludge becoming "activated" very rapidly. At the surface immediately over the diffusers there is however, violent agitation, which does not occur between the diffusers, and the formation of large air-bubbles would seem to indicate that this method of applying the air is not uniform, and that it will be necessary if the air is to be introduced at the bottom that the floor of the tank should be completely covered with diffusers, and if constructed of the present type on a large scale would be extremely costly. On the other hand the cross ridge and pocket formation would be most difficult to empty and cleanse. Whilst the aëration was proceeding it was apparent that the porosity of the tiles was very uneven and the tiles unsuited for the purpose, and that the ideal false floor which must be economical in cost and easily cleaned has yet to be evolved.

Since it appears that such a floor is imperative to the process an observation shaft 12-in. square has been constructed for the purpose of experimenting with various materials and tiles. The shaft is so designed that it will be possible to observe the diffusion of the air, and by means of taps placed in the side to take samples at depths varying from 1 ft. to 8½ ft.

The aërating tank is worked on the "fill and draw" principle, taking about half an hour to fill, two hours blowing, two hours settlement, and half an hour to empty—making a five hours' cycle.

In this tank the air is used for both oxidising and agitating the sewage simultaneously, but it might prove of considerable advantage if the circulation of the sludge could be obtained by mechanical apparatus, using the air for oxidation only, thereby effecting a considerable saving in air consumption.

Whether the "fill and draw" method will eventually prove to be the simplest to work and give the best results, or whether a properly designed continuous flow treatment will be the more effectual remains for further investigation. If the engineering difficulties in the way of carrying out the process can be overcome it should be possible to purify sewage in tanks having a capacity of five or six hours flow of sewage. At the present time tanks are constructed larger than this merely for the settlement or precipitation of the suspended matter from the sewage, but in the new process the suspended matter in the sewage is so altered in character that it settles very readily.

The "activated sludge" is quite inoffensive, dark brown in colour, flocculent in character and separates rapidly and completely despite its low specific gravity, is inodorous and readily drained.

The chemical analyses of an average sample of the "activated sludge" and precipitation sludge are compared in the table in next column.

The moisture in the precipitation sludge is 91·1 per cent and in the "activated sludge" 96·73 per cent.

None of the forms of sludge generally produced are of much value as manure, but attention should be drawn to the abnormally high percentage of nitrogen in "activated sludge" as compared with ordinary unoxidised sludge.

Since the sludge in a dry state contains 4·59 per cent of nitrogen it should become a saleable product of high manurial value, and if not a source of revenue should at least cease to be the drag and bugbear at all sewage disposal works.

The purification of sewage by forced aëration has been demonstrated as a scientific fact by Dr. Fowler, who is admittedly on correct lines, and the object of

Analysis of an average sample of dried

	Precipitation sludge.	Activated sludge.
	Percentage.	Percentage.
Organic matter ...	56·14	13·39
Mineral matter ...	43·86	86·61
Nitrogen, free and saline ...	—	·052
Total nitrogen (Kjeldahl)	1·50	4·59
Iron (Fe_2O_3)	1·51	9·67
Phosphate (P_2O_5)	·695	2·71

presenting these notes is not to prove the principle of forced aëration, or to make pretensions of having solved any of the difficulties, but to arouse the interest of engineers so that by concerted action we may translate Dr. Fowler's experiments to a working scale of an extensive character.

Up to the present the matter has been dealt with almost exclusively by the chemists, but the small open tank and the few experiments conducted therein at Wakefield have proved that the engineering difficulties to be faced are numerous. These can doubtless be overcome by experimental work, but more money is required for such purpose than the author has at present at his command.

One of the greatest possibilities of the process lies in the fact that it may be feasible to effect in tanks a much higher percentage purification than has hitherto been accomplished, so that the effluent might be applied to existing filters at a high rate, and thus avoid extension of filter area.

If sufficient energy and money were expended on this aëration principle there is ample justification for assuming that disposal works could be designed which would possess the following advantages:—

(1) Since the rate of purification would be accelerated, sanitary conditions would be improved.

(2) The residual sludge, owing to the ease with which it could be handled and its high nitrogen content, would be more readily converted into a valuable fertilising agent.

(3) Putrefaction would be less likely to occur, thus avoiding offensive smells, and if percolating filters could be dispensed with fly troubles would cease.

(4) A very high percentage of purification could be obtained yielding an effluent which would be non-putrefactive on incubation.

(5) Smaller outfall works would suffice, thus effecting a reduction in the area of land required.

(6) Reduction in capital costs for the following reasons:—

(*a*) Purification would be accomplished by single tank treatment, obviating the necessity for bacterial filters; tank capacity would be less than that required for preliminary treatment in either septic or sedimentation tanks.

(*b*) Owing to the improved sanitary conditions, the absence of smell, and the reduction in area of land required, the sites of works might be much nearer towns, and on areas which, under present methods, would be impossible, or open to grave objections. The length of outfall sewers would consequently be curtailed.

(7) Reduction in maintenance costs for the following reasons:—

(*a*) Chemicals would be unnecessary with a corresponding reduction in the bulk of sludge to be manipulated.

(*b*) The sludge being of higher manurial value for agricultural purposes, doubtless the revenue derived from its sale would at least meet the cost of its removal.

(*c*) Works being smaller and more compact, the expenditure on supervision and attendance would be reduced.

The author is indebted to the Works Committee of the Wakefield Corporation for permission to publish these results and investigations.

D*

NEW BOROUGH ENGINEER OF WOOLWICH.

Mr. J. Sutcliffe, Assoc.M.Inst.C.E., borough surveyor of Deptford, who was on Wednesday appointed borough engineer and surveyor of Woolwich, has had an experience in the municipal engineering profession of more than thirty years, of which the last fourteen years have been in London. He began when quite young as an assistant at Burnley. Here he was engaged in the construction of four wrought-iron girder road bridges, a lattice-girder footbridge, the building of the new corporation store-yard, the construction of tramways, and other works, including river-bed pitching. For two out of the five years he was at Burnley he was engaged in private practice, and among the projects with which he was concerned were the water supply scheme at Bishop's Castle, St. Helens' tramways, extension of Sunderland waterworks, and the works reservoir at Astley Bridge. On obtaining an

Mr. J. Sutcliffe, Assoc.M.Inst.C.E.

appointment at Bolton, where he remained two years and a-half, he prepared a plan of all the borough sewers and drains. The new railway station schemes also engaged his attention, as well as tramway construction, alteration of market hall, the construction of six tennis courts in the public park, the conversion of old rubble soughs, 5 miles in length, into stoneware pipe sewers, river retaining wall, additions to fever hospital, and a wrought-iron girder road bridge. At Horwich, where he held office for one year, his chief works were the new main intercepting sewer, 2 miles in length, and an extension of the main sewer.

On obtaining the appointment of deputy borough engineer of Warrington Mr. Sutcliffe found ample scope for his activities. New public baths, a small-pox hospital and new municipal offices were built, and extensive sewerage schemes carried out, while the extension of the borough boundaries, involving, as such schemes always do, an immense responsibility upon the officials engaged in the preparation of the Parliamentary Bill, was successfully dealt with. Another scheme upon which he was engaged was the Wilderspool-road improvement, including the widening of the thoroughfare from an average of 30 ft. to 60 ft., at a cost of £8,600.

During the eight years Mr. Sutcliffe was at Warrington no fewer than 243 private street improvements were carried out under the Private Street Works Act, 1892, at a cost of £37,544. Subsequently Mr. Sutcliffe became assistant borough surveyor of Lambeth, where extensive works of wood and asphalt paving came under his direction. Other works included wharf (£15,000), disinfecting station and stables (£2,000), extensions of coroner's court and mortuary, and sewer flooding prevention schemes. The catalogue of his works at Deptford is numerous and varied. It comprises schemes of highway maintenance, construction, and reconstruction in permanent and macadam surfaces by direct employment of labour; main road widenings for tramway extension purposes by direct labour; design for baths and washhouses; design for public library; designing and building new workshops at depot (direct labour); construction of road material staithes (direct labour); and many other important public works.

In short, Mr. Sutcliffe's career has been one of continuous activity, and not the least responsible part of his task has been the time he has devoted to the preparation of Bills for schemes requiring the sanction of Parliament.

LONDON CITY ENGINEERSHIP.

CHIEF ASSISTANT'S PROMOTION.

Mr. E. E. Finch, M.Inst.C.E., who was appointed chief assistant in the engineer's office of the Corporation for London in December, 1909, was at yesterday's meeting of the Court of Common Council unanimously

Mr. E. E. Finch, M.Inst.C.E.

promoted to the post of city engineer at a salary of £800 per annum.

Prior to joining the city engineer's office, Mr. Finch was for over six years the borough engineer of Bethnal Green, and for seven years chief assistant engineer of Bermondsey. He previously held junior appointments at Bermondsey and Chelsea.

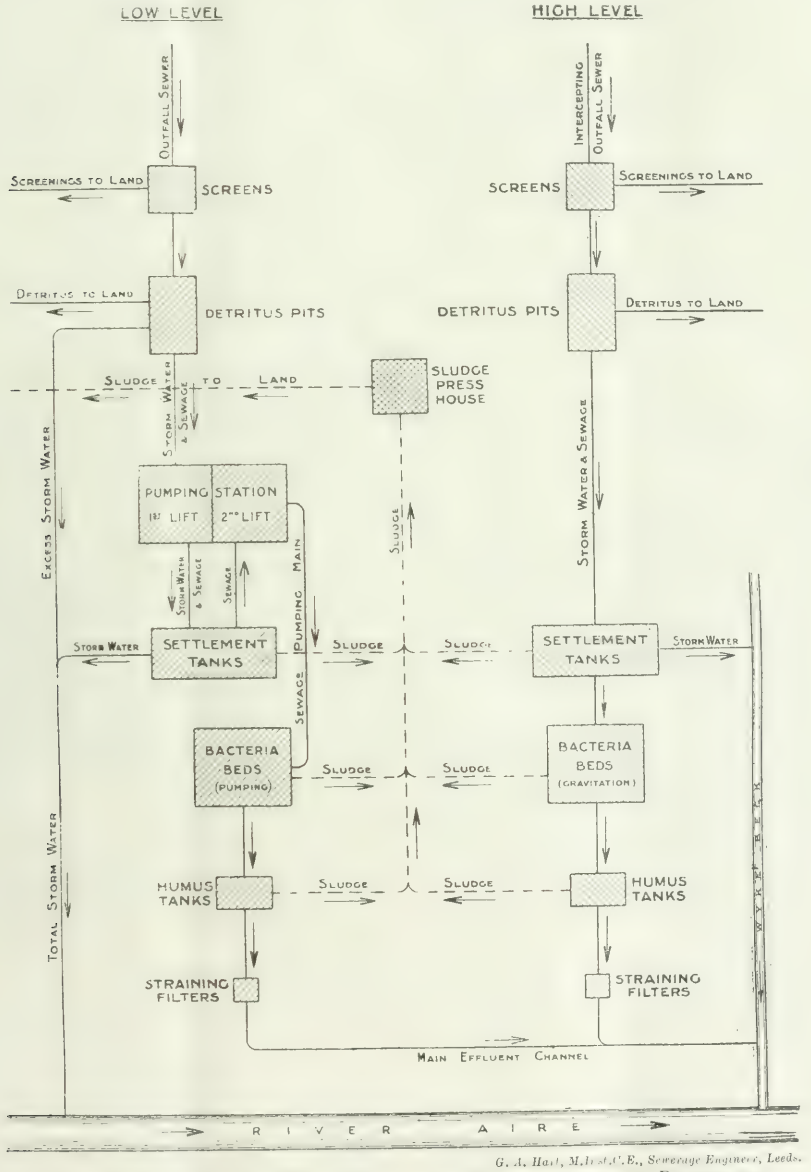
During the time Mr. Finch has been with the City Corporation over £800,000 has been expended in settlements of compensation claims in connection with the widening of Fleet-street, Bishopsgate and Leadenhall-street, the whole of the work being carried out by the engineer's staff.

In addition to being a member of the Institution of Civil Engineers, Mr. Finch is a member of the Institution of Municipal and County Engineers and of the Royal Sanitary Institute.

Leeds Main Sewerage and Sewage Disposal.

CITY SEWERAGE ENGINEER'S ADDRESS TO WORKS MANAGERS.

On the occasion of their recent annual summer conference at Leeds the members of the Association of Managers of Sewage Disposal Works—as stated in our issue of the 9th inst.—paid a visit of inspection to the extensive new works of sewage disposal which Mr. George A. Hart, M.INST.C.E., the sewerage engineer to the corporation of that city, is at present engaged in carrying out. The sewage of the city drains to four sewage works—viz., (1) the main sewage works at Thorpe Stapleton, near Knostrop, now in process of reconstruction, and (2) Redley sewage works, (3) Killingbeck sewage works, (4) Stanks sewage works. The latter three works are of an entirely subsidiary nature, and deal with the sewage of small areas of the city on the boundaries. The new works form part of the huge scheme of main sewerage and sewage disposal authorised by the Leeds Corporation Act of 1908, and estimated to cost, inclusive of land and easements, £1,277,000, and their principal engineering features were outlined in an interesting address which Mr. Hart delivered to the members of the association prior to the inspection referred to.



G. A. Hart, M.Inst.C.E., Sewerage Engineer, Leeds.

THORPE STAPLETON SEWAGE WORKS: DIAGRAM ILLUSTRATING METHOD OF PURIFICATION.

In a historical *résumé* of the events which led up to the adoption of the 1908 scheme, went back to the year 1848, when Leeds was visited by an epidemic of cholera. The construction of the first instalment of main public sewers, having an outfall

direct into the river Aire, followed seven years later, and in 1872 the corporation purchased 26 acres of land from the Templenewsam estate as a site for purification works. In 1874, when the population of the city was 275,000, pumping plant and settlement tanks were installed at Knostrop, and chemical precipitation with lime was first adopted, the total tank capacity provided being 2,500,000 gallons. The cost of these works, including site, was £57,000.

The year 1894 saw the commencement of the so-called Leeds experiments, and the biological treatment of sewage at the Knostrop works. A year later the corporation acquired 70¼ acres of land at Rodley, in the urban district of Horsforth, as a site for the establishment of purification works for a portion of the city area in the Stanningley and Bramley townships.

Two years later the settlement tank accommodation at Knostrop was increased by the addition of seven tanks, bringing the total tank capacity up to 5,500,000 gallons. In 1905 the Rodley sewage works were completed. In 1907 the West Riding Rivers Board instituted proceedings against the corporation to restrain them from polluting the river Aire, and the Court issued an order requiring the city authorities temporarily to remodel their existing sewage works at Knostrop as a tentative undertaking for the purpose of eliminating the greater part of the solid matter contained in the sewage, and to obtain powers to undertake a complete scheme of purification. These powers were duly obtained by the Act of 1908, under which the town council acquired an area of 600 acres of land forming part of the Templenewsam estate, near Knostrop. The temporary reconstruction of the existing sewage works was completed in July of the same year, and a commencement was made with the new works in 1909.

GENERAL.

Leeds, Mr. Hart proceeded, has an area at the present time of 26,263 acres, and an estimated population of 459,260, of which it is estimated that 437,152 drain to the existing works at Knostrop. The dry-weather flow of sewage is 15,750,000 gallons per day, representing 36 gallons per head of the population, of which 24 gallons per head is computed to be domestic and 12 gallons per head trades effluent and infiltration water. The dry-weather flow of sewage for future requirements has been computed at 40 gallons per head—viz., 25 gallons per head domestic, and 15 gallons per head trades effluent and infiltration water, a population of 650,000 persons, with an ultimate dry-weather flow of 26,000,000 gallons per twenty-four hours being provided for.

The maximum wet-weather flow to receive full treatment under the scheme is 60,000,000 gallons per twenty-four hours, being 2·30 dilutions of the dry-weather flow, while a further additional volume of 60,000,000 gallons per twenty-four hours is to be treated as storm water.

The scheme divides the city into high and low level main drainage areas. The high-level area extends over 13,945 acres, with an estimated present population of 190,000, and a corresponding dry-weather flow of sewage of 5,750,000 gallons a day. The population may ultimately be increased to a population of 298,000, with a corresponding dry-weather flow of 12,000,000 gallons a day. This high-level drainage area comprises the townships of Woodhouse Carr, Buslingthorpe, Burley, Headingley, Weetwood, Meanwood, Chapel-Allerton, Chapeltown, Gledhow, New Leeds, Richmond Hill, Shadwell, Roundhay, Seacroft, Coldcoates and part of Osmondthorpe.

This high-level drainage area will drain into the system of new high-level main intercepting sewers comprised in the sewage scheme, the total length of which is about 8 miles, and which commence in Kirkstall and extend right through the centre of the city on the north bank of the river Aire down to the sewage disposal works site.

In the low-level drainage area provision is made for an ultimate population of 352,000, with a dry-weather flow of 14,000,000 gallons per day. The existing main outfall sewer discharging at Knostrop will form the outfall of the low-level drainage zone. The whole of the sewage and storm water will require to be pumped at the outfall of the main sewer before it can be treated in tanks, and the sewage which requires further treatment will require to be pumped from the tanks to the site of the bacteria beds as second lift. The whole of the sewage and storm water from the high-level drainage area will be treated by gravitation.

Describing the works for treating the low-level drainage area flow of sewage and storm water, Mr. Hart stated that the maximum volume to be treated as sewage at present is 23,000,000 gallons a day, the ultimate quantity being 32,500,000 gallons per day. The additional volume of storm water to receive preliminary treatment in tanks is at present 23,000,000 gallons per day, the ultimate quantity being 32,500,000 gallons per day.

SCREENING.

The first treatment to be given to the sewage and storm water will consist of screening. Four screens will be provided in the present installation as preliminary roughing screens, their dimensions being 9 ft. wide by 11 ft. 6 in. high. The bars will be 3 in. deep by ⅜ in. thick, and the space between the bars 3 in. Each screen will be cleaned by a rake, hand-operated, after which the flow will be passed through fine screens consisting of four screens each 12 ft. wide by 10 ft. 6 in. deep, formed with rounded front edges, the size of bars being 3 in. deep by ½ in. by ½ in., and the space between bars being ⅝ in. Each screen will be cleaned with power-driven travelling rakes, which will discharge the screenings automatically into steel hoppers with bottom doors, which will then discharge the contents into railway wagons. The height from the bottom of the screen to the delivery level of rakes will be 28 ft.

Each pair of screens will be driven by an electric motor, with friction-clutch disconnecting gear. The driving gear of the screens is so arranged as to give a variable chain speed of 25 ft. per minute for ordinary flow, capable of being increased to 50 ft. per minute in storm time. The motors are connected to the screen driving shafts by enclosed worm gearing. Each motor driving two screens will be of 11-h.p., and running 730 revolutions per minute. The combined sewage and storm water will be passed through detritus or grit pits, four of which are included in the first installation, and each pit will be 90 ft. long by 13 ft. wide by 12 ft. 6 in. average depth measured below top water level. The total displacement of the four pits will be one-thirtieth of the present dry-weather flow. Each detritus pit will be provided with inlet and outlet controlling sluice gates.

PUMPING PLANT.

After leaving the detritus pits the combined sewage and storm water will be conducted into the low-lift pump suction well adjoining the new low-level sewage pumping station, from which the combined flow of sewage and storm water to the extent of 4·6 times the dry-weather flow will be lifted by an installation of direct-coupled electric motor-driven centrifugal pumps, and discharged into sewage settlement tanks through a 60-in. diameter cast-iron main. A 60-in. Venturi meter and recorder will measure the volume passing from these pumps into the tanks. The first lift pumping machinery will consist of six units—two of 6,000,000 gallons per twenty-four hours' capacity, two units of 12,000,000 gallons per twenty-four hours' capacity, and two units of 24,000,000 gallons per twenty-four hours' capacity—which will provide for a maximum volume of 60,000,000 gallons per twenty-four hours to be pumped, with one spare unit equal in capacity to the largest unit. The pumping head will vary from a minimum of 7 ft. to a maximum of 14 ft. 3 in., with an average pumping head of 12 ft. The maximum b.h.p. of the motors are as follows: 16,000,000-gallons unit, 25-b.h.p.; 12,000,000-gallons unit, 47-b.h.p.; 24,000,000-gallons unit, 90-b.h.p.; making a total of 324-b.h.p. to be installed for the first pumping lift.

Electric current will be provided from the city main generating station by underground cables, which will be laid in duplicate for a distance of 3 miles. The current will be delivered at the sewage works at a pressure of 6,600 volts, three-phase alternating current, fifty cycles periodicity. The motors to the pumps will be arranged for 2,000 volts pressure. Storm water from the low-level works in excess of 4·6 times the dry-weather flow will be separated by a storm-water intercepting weir constructed in the first lift pumping well.

Sewage tank accommodation for treatment of sewage is twelve hours' dry-weather flow, and for storm water eight hours' dry-weather flow—a total of twenty hours with not less than one spare unit. The tankage upon the low-level consists of six tanks, each divided into four compartments, having a total capacity of 11,500,000 gallons. The tank effluent will then pass into the second lift pump well, in which a separating weir will divide the flow of sewage from the storm water. The storm water in excess of 2·3 times the dry-weather flow, and up to 4·6 times the dry-weather

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flow, will pass into the storm-water overflow channel, and thence into the river Aire.

The flow not exceeding 2½ times the dry-weather flow will be pumped by an installation of direct-coupled electric motor driven centrifugal pumps through a 54-in. diameter rising main to the site of the bacteria beds. This plant will consist of five independent units—viz., two of 6,000,000 gallons per twenty-four hours' capacity, and three of 12,000,000 gallons per twenty-four hours' capacity, making a total of 48,000,000 gallons per twenty-four hours' capacity installed, which allows of one large unit in reserve as spare. The total lift, including frictional resistance of the second lift, is 30-ft. head.

The pump-house will also contain one 12,000,000-gallon per twenty-four hours' unit of 39-b.h.p. capacity for pumping off supernatant water from the tanks, and also two electrically operated vacuum priming pumps, each displacing 50 cub. ft. of free air per minute, and fitted with 6-b.h.p. motors running 1,500 revolutions per minute; also one vertical spindle centrifugal house-pump, with inverted motor direct coupled for emptying the sump, and fitted with one 13-b.h.p. motor running 750 revolutions per minute, the pumping capacity being 1,200 gallons per minute.

The whole of the sewage pumping plant will be electrically operated. The motors for the first lift pumps, second lift pumps and supernatant water pumps are of the horizontal type design with three-phase alternating current, having a periodicity of fifty cycles, with a pressure of 2,000 volts. They are protected with rotors of the squirrel-cage type. The starting arrangements of each motor will consist of an auto-transformer starter capable of starting the motor three times per hour. They are of the air-cooled type, enclosed in metal cases. The motors for the house pump and for the priming pumps are designed to operate with a pressure of 346 volts between the phases.

The low-level sewage pumping station will be 124 ft. 6 in. by 52 ft. 3 in. wide by 42 ft. high from floor level to halfway up the roof.

A rising main of cast-iron pipes, 54-in. diameter, will be laid from the pumping station and connected with the second lift pumping machinery to convey the low-level tank effluent to the site of percolating bacteria beds or filters which are situated on ground 25 ft. above tank-top water level. The dry-weather flow of tank effluent from the low-level area to be provided for will amount to 10,500,000 gallons a day, which may eventually increase to 14,000,000 gallons a day. The corresponding maximum wet-weather flow to be treated upon the bacteria beds of the low-level area will be 24,000,000 gallons per twenty-four hours, which may ultimately be increased to 32,500,000 gallons per twenty-four hours.

BACTERIA BEDS.

The percolating filter or bacteria beds for the low-level area will consist of 18 acres of an average depth of 6 ft., divided into three independent blocks each of 6 acres capacity. Each 6-acre block is subdivided into three units, each of 2 acres in area, which are each provided with independent sewage effluent connecting channels, and gauge basins with measuring weirs.

The sewage distributors upon the beds will consist of travelling rectangular sewage-driven machines of the mono-rail waterwheel type for an area of 6 acres in 2-acre units, each 2-acre unit being supplied with three feed channels, and each channel provided with two distributors. The remaining 12 acres of beds will be divided in 6 acres of two units each, and supplied with light cast-iron pipes fitted with spray jet nozzles ranged in rows at centres of 11 ft. apart. The rate of distribution of tank effluent over the surface of the beds is designed for a maximum rate of 2,000,000 gallons per acre per twenty-four hours, being at the rate of 400 gallons per square yard per twenty-four hours, or 200 gallons per cubic yard of medium per twenty-four hours. The capacity of medium provided will admit of a dry-weather flow of 68 gallons per cubic yard per day, with a corresponding maximum wet-weather volume of 136 gallons per cubic yard per day.

The medium for the bacteria beds will consist of various materials—namely, washed gravel, slag, limestone, dolomite, screened and graded from 1 in. to 3 in. in size, the larger material being placed at the bottom of the bed with the finer material at the surface. The effluent from the bacteria beds will subsequently be passed through upward-flow settlement humus tanks containing shallow straining filters to intercept the periodical discharges of humus, and varied organisms which are shed from the percolating bacteria beds throughout the year. The capacity of these tanks to be provided will be governed by a maximum rate of upward velocity of flow of not exceeding 5 ft. per hour as a maximum in dry weather, or of 10 ft. per hour as a maximum wet-weather flow rate.

The effluent from the humus tanks will be discharged into a new main effluent channel, which is being constructed for a length of ¾ mile, discharging into the river Aire and the extreme south-east boundary of the sewage works estate. This outfall channel also receives the surface water proceeding from an area of 6,650 acres of agricultural land within the area of the city of Leeds, and the main outfall channel will be capable of dealing with the whole flow of sewage of an ultimate population of 940,000 persons, or rather more than double the present population. The sewage purification works required for the high-level drainage area proceeding from the new high-level intercepting sewer will be of precisely similar character to the low-level area already described save that no pumping plant will be required.

The estimated dry-weather flow to be discharged by the new high-level intercepting sewer will be about 5,500,000 gallons per day, which may ultimately be increased to 12,000,000 gallons within the next thirty years. The treatment to be given to the sewage will consist of screens with subsequent settlement in detritus pits, after which the sewage will be treated in sewage tanks, and assisted by chemical precipitation in common with the storm water up to a maximum rate of flow of 4⅔ times the dry-weather flow. After receiving treatment in tanks all flow in excess of 2½ times the dry-weather flow, or 92 gallons per head of the population, will be separated from sewage by an automatic weir, and discharged directly into the stream called Wyke Beck, and then through the main effluent channel into the river Aire. The dry-weather flow of sewage and excess flow up to 2½ times the dry-weather flow, or 92 gallons per head of the population, will be conveyed to a separate area of percolating bacteria beds or filters, 12 acres in area, of similar construction to the low-level beds previously described, save that the distributors will consist of electric motor-driven travelling rectangular distributors hauled by endless wire ropes. Each motor will govern an area of 1½ acres of filter, there being two motors in each motor-house and two motor-houses to each 6-acre unit of bacteria beds. For distribution purposes each 6-acre unit is thus subdivided into eight sections of ¾-acre area, and each ¾-acre section is provided with two distributor machines yoked together and running in tandem fashion, and hauled by the same endless rope.

Each distributor will be 70 ft. 7⅜ in. span, with a length of travel of 240 ft.

In normal dry-weather time the machines will distribute only when travelling in one direction.

The maximum quantity of liquid to be passed on to the surface of the beds at the time of maximum flow is 2,000,000 gallons per hour per 24 acres. The whole area of the bacteria-bed floor will be covered with aërating tiles, and each ¾-acre section of bed will be provided with a ventilating passage. Gauge weirs and basins will be constructed in the effluent channels of each 1½ acres of bed. The bacteria-bed effluent will be passed through upward-flow humus tanks in combination with upward shallow straining filters of similar construction to those in the low-level works, and the whole high-level effluent will be passed over a gauge weir and basin before being passed into the main effluent channel and thence into the river Aire.

SLUDGE TREATMENT.

The whole of the sludge deposited in the settlement tanks of both the high and low level systems will be dealt with in a sludge-pressing plant to be erected on the low-level sewage works site at Knostrop. The sludge from the high-level works will be pumped out of the high-level tanks to the low-level works, and treated there in combination with the sludge from the low-level tanks.

The sludge arrested in the humus tanks and in washing out the channels of the tanks and bacteria beds will be drained to a low-level sump, and then pumped back to the low-level sewage works at Knostrop to be pressed in common with the sludge arrested in the tanks. The volume of sludge to be dealt with at the present time will amount to about 700 tons (90 per cent water) per day, which will eventually be increased to 1,200 tons per day. The sludge will be stored for a period of twenty-four hours in settlement tanks, by which the density of the sludge will be reduced to about 88 per cent water, and subsequently this sludge will be pressed down to a semi-dry substance containing 60 per cent water. The volume of sludge cake (60 per cent water) resulting from this process will amount to 175 tons a day, which will eventually be increased to 300 tons a day. The pressing plant will consist of sixteen presses, each containing sixty-four cells, 52 in. square by 1½ in. deep, each press being capable of holding 4½ tons of cake; thus, for dealing with the ultimate quantity of 300 tons of cake a day each press will require to be discharged four times a day, and this operation can readily be performed in a ten and a-half hours working day. It is found that the time required to make a satisfactory cake from Leeds sludge varies from sixty to ninety minutes, depending upon the density of the sludge dealt with. The cake from the presses will be delivered into railway wagons on the ground floor of the press-house, and then disposed of either to agriculturists or taken to tip upon the sewage works lands on a narrow-gauge railway line, and there covered with soil.

There is an area of 200 acres of land on the sewage works estate available for the reception and disposal of sludge cake, in common with the detritus and garbage removed from the screens. This will meet all the city's requirements in sludge disposal for the next thirty years. The lands are comparatively low-lying, having a frontage to the river Aire, and are protected from flooding by an embankment.

It is intended to plough and replough the surface of the deposited cake in common with a mixture of fine ashes and soil, and subsequently convert the surface into arable land, and farm it accordingly.

As stated, the total estimated capital outlay in connection with the scheme is £1,277,000. The total capital expenditure incurred up to March 31, 1915, amounted to £400,916, and the corporation have existing contracts placed for construction of works which increases their further liabilities by an additional £276,000.

The whole of these contracts were due for completion in two years from the present time, but in view of the shortage of labour and the necessary curtailment of expenditure of capital in order that our resources can, as far as possible, be placed at the disposal of the Government for the protection of our national interests, there is little prospect of any rapid development upon this public health undertaking.

Greenock Electricity Profits.—The surplus shown by the accounts of Greenock Corporation electricity department for the year ending June 30th is a record for the undertaking, amounting in all to about £10,000.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Would it not be of great assistance if the Road Board could now, with the experience they have gained, give us some standard by which we could measure the behaviour of any class of road construction in relation to the traffic which it has to bear? In this connection, could not the first cost of construction and subsequent cost of maintenance be reduced to a standard of, say, hundredths of a penny per ton-mile of traffic? As, however, water is now well known to be almost as great an enemy to roads as traffic, would not such a standard be somewhat misleading unless all the conditions were known?

* * * *

Apropos of the above, is it not interesting to see by the report of the National Physical Laboratory in connection with road testing on the rotary machine that, unless water was added to the surface of the road under test, it was impossible, with certain trials, to make any impression on the surface; but that, no sooner was water added than there were signs of wear and disintegration? Under these circumstances should not the construction and maintenance of roads in dry climates be reduced to a much more simple problem than it is with us?

* * * *

Does it not seem rather difficult for local authorities to economise when we read that the Droitwich Rural District Council some weeks ago passed a resolution suspending work on the roads for three months, with the result that the men who were dismissed, instead of going as farm labourers as anticipated and desired, immediately found work on the roads under the county council at increased wages? Is it not to be regretted that through want of uniform action this country still remains in a more or less chaotic condition as regards the useful employment of labour during this great crisis?

* * * *

Is it not very satisfactory to see, by the report of Mr. Cozens, the highway surveyor to the Isle of Wight Rural District Council, that, "where the highways had been tar-sprayed, and particularly where the tar was in good condition, the roads did not suffer nearly so much [from the abnormal rainfall] as in places where no tarring had been done"? Does not the experience of road surveyors throughout the country coincide with that of Mr. Cozens?

* * * *

Did not Dr. Savage's excellent paper at Yeovil draw attention to the crying evil of small water supply schemes? Is it not a fact that thousands of pounds are practically frittered away on small isolated village schemes, whereas a good, comprehensive scheme covering large areas of supply could be carried out at a much more reasonable cost? Is it not often found that a "combined district" could be formed geographically under the control of a Water Board, instead of the whole area being split up into small schemes of a relatively costly nature? Is not this failure to form joint boards due, in most cases, to the jealousies which exist among small local authorities? How is it to be altered?

* * * *

Is it a fact that the corporation of Dublin are making an application to borrow £67,425 for housing purposes, and that the rents proposed for these houses are 5s. a week short of the self-supporting basis? And would not this represent a loss to the rates of over £2,000 a year? How does this proposal fit in with the cry for municipal economy? Is there not a well-known saying that "Any fool can buy sovereigns at thirty shillings each"?

* * * *

Was it not a good suggestion on the part of Mr. Partington in the House the other evening that the London County Council and the directors of the London General Omnibus Company should have a conference "with a view to securing temporary co-operation between the two services, thereby releasing men of military age and avoiding unnecessary expenditure"? Would not this be a consummation devoutly to be wished? But is it to be expected that the wolf will lie down with the lamb? By the way, which *is* the wolf in this case?

Chester Tramways.—It appears from a report submitted to the Chester Town Council that within the next two or three years the whole of the corporation tramway track will have to be renewed, at a probable cost of £15,000.

Sewage Disposal at Southall-Norwood.*

By REGINALD BROWN, M.INST.C.E., M.I.MECH.E., F.S.I., Engineer and Surveyor to the Urban District Council.

The drainage of the district is, generally, on the separate system, rain water from roads, yards and houses being kept quite separate. The original scheme was carried out in 1888, but the rain water from some of the older houses was allowed to discharge into the soil sewers. This, together with the leaky condition of some of the sewers, is the cause of a very large flow in gallons per head, which is referred to under sewage disposal works.

During the past fourteen years a considerable length of sewers and surface-water drains has been laid down, at a cost of about £8,000. The sewers are continually flushed by means of a flushing van, and a record is kept of the dates on which particular sewers are flushed, and the quantity of water used.

SEWAGE DISPOSAL WORKS.

The sewage disposal works were laid down, while the district formed part of the rural district of Uxbridge, in 1888, by the late Mr. John Anstie, M.INST.C.E. The works at that period comprised an area of about 19 acres, 11 acres of which were suitable for irrigation, the remainder being taken up by roads, disposal works and land unsuitable for either, as it had been part of the bed of the river Brent (which was diverted when it was canalised by the Grand Junction Canal Company). The works, as originally constructed, consisted of a set of tanks to receive the district sewage (now used as detritus tanks), and another set for the sewage from the London County Asylum (Hanwell), with chemical and engine houses, and manager's residence. The set of tanks receiving the district sewage (now used as detritus tanks) consisted of two small tanks covered with corrugated iron, each 60 ft. long, 10 ft. wide, and 3 ft. 3 in. deep, and having a total capacity of 25,000 gallons, and two precipitating tanks (now converted into straining filters) of about 100,000 gallons total capacity. In 1896 two additional precipitation tanks (also now used as straining filters), having a total capacity of 100,000 gallons, were constructed, but, owing to the rapid growth of the district and the admission of certain trade liquids into the sewers, it soon became apparent that additional provision would have to be made. The authority for the time being thought it advisable to convert three of the existing precipitation tanks into contact beds (filling medium, clinker) for the district sewage, leaving the fourth tank to act as a precipitation tank for the asylum sewage. The district sewage was passed direct to the contact beds without any treatment, except sedimentation in the small tanks referred to above. The distribution of the sewage to two of the contact beds was by open channels only, while the third bed was fitted with a Candy automatic sprinkler (one of the first of its kind fixed). The effluent of the first two contact beds passed to a second contact bed (filling medium, coke breeze) some distance away. This latter bed is of fine material with earth sides, and is about 117 ft. 6 in. long, 80 ft. wide, and 4 ft. 6 in. deep. The effluent from the precipitation tank passed through two small contact beds, now obsolete, each 30 ft. long, 20 ft. wide, and 3 ft. 3 in. deep (filling material, clinker). The effluent from the bed referred to above as being fitted with the Candy sprinkler was passed through two small beds (filling material, Polarite), now obsolete. The tanks receiving the Hanwell Asylum sewage are two in number, and are covered. These tanks are each 35 ft. long, 34½ ft. wide, and 3¾ ft. deep, the combined capacity being about 57,000 gallons. The sewage was lifted through an 8-in. rising main, by means of centrifugal pumps, into the precipitation tank referred to previously, but is now lifted and mixed with the incoming district sewage. The accumulated sludge was run into a sludge well near the low-level tanks, and pressed into a cake by means of one filter press. The whole of the machinery was driven by gas engines, the gas being supplied by a Dowson gas generating plant (one of the first of its kind to be used). It ought to be mentioned here that a Smith's patent revolving wire screen was also used for screening the sewage before it entered the works, Southall-Norwood, so far as the author is aware, being the first place (after Sutton—its home) to adopt such a screen. The chemical house contained lime mixers and crushers driven by a gas engine.

FIG. 1. VIEW OF TILE-OX FILTERS OF PERCOLATING BEDS, SOUTHALL NORWOOD SEWAGE WORKS.

Such is a brief description of the works in 1901, when the author became professionally associated with the district.

In 1901 the author prepared plans for remodelling the works, by constructing four additional precipitation tanks (600,000 gallons total capacity) and ten contact beds, having a water capacity of 900,000 gallons—three fillings per day—as the character of the sewage of the district required, in the author's opinion, that chemical precipitation, combined with beds, should be adopted to deal with it. In passing, it may be mentioned that the character of the sewage was such that it caused a fine film to form over the surface of a clinker bed within an hour after the first application, absolutely preventing percolation.

Certain other alterations were made, and a description, with some of the details, may be interesting, as

* From paper submitted at a recent Eastern District meeting of the Institution of Municipal and County Engineers at Southall-Norwood.

in many cases success is due to attention to small details.

The Smith's revolving screen was retained, but the wire band has been abandoned and perforated plates used instead. The wire band had a life of about nine months, whereas the plate screen, although about double the first cost, has at least four times the life.

The power from the waterwheel—when driving the screen last mentioned—is utilised to work an arrange-

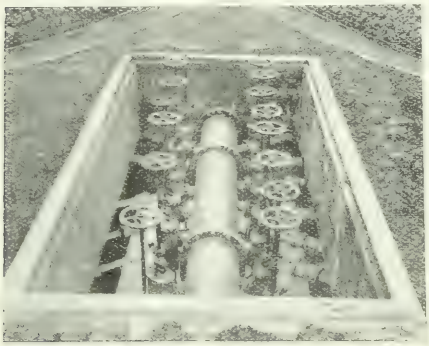


Fig. 2. View of Control Chamber to Percolating Beds.

ment for supplying "milk of lime" to the sewage. The apparatus is very simple. It consists of an extension of the axle of the waterwheel into the liming-house, where its horizontal action is converted into a vertical revolving action by means of bevel wheels. Attached to the bevel wheels controlling the vertical revolving action is a rod which passes up through a small circular iron tank, the rod having mixing arms. The axle of the waterwheel also actuates an enclosed sieve for sifting the lime, and an elevator for lifting the sifted lime into the liming tank. The number of revolutions of the waterwheel automatically controls the amount of lime added to the sewage. This simple apparatus has effected a saving on the continual running of a gas engine, which was at one time necessary to drive the old mixing machine.

TANKS.

Owing to the great variation in the level of the ground, and the desire of the author to control, by gravitation, a considerable area of possible between the tanks and the canal, into which the effluent discharges, and the cramped nature of the site, it was necessary to adopt rather heavy construction in the main walls of the tanks. Part of the floors of two of the tanks had to be carried on arches. The whole of the walls were constructed of Portland cement concrete, gauged 5 parts of clean ballast, 1 of clean sand and 1 of Portland cement, and owing to the close proximity of the old river bed, it was necessary at one point to go down some 17 ft. below ground level, and put in a concrete abutment 11 ft. square. The thickness of the walls is 6 ft. at floor level of tanks, and 3 ft. at the top, the end wall being supported with buttresses having a 2-ft. projection. The tops of the walls are formed as carriers by means of earthenware channels and coping. The tanks are provided with the usual scum boards, floating arms and sludge valves. A walking-way extends along the top of the wall next to the engine-house, and is protected by means of an iron guard-rail. From these tanks—on its way to the beds—the liquid flows along an overhead carrier.

BEDS.

The three contact beds originally in use had the clinker removed from them, reburnt to free it from the large amount of sewage sludge it contained, and replaced; but the opportunity was taken to provide the usual ventilating and draining pipes. Ten other beds were constructed, as follows:—

Four beds 50 ft. long by 40 ft. wide and an average depth of 4 ft.

Four beds 68 ft. long by 40 ft. wide and an average depth of 6 ft.

Two beds 118 ft. long by 40 ft. wide and an average depth of 6 ft.

The beds are drained by means of perforated pipes laid diagonally on the botom, leading to a central channel, covered with a perforated, semi-circular stoneware cover.

The deep beds are also provided with a set of perforated pipes laid in the filling at the centre of their depth, for the purpose of aëration. These pipes are laid across the beds at right angles to the side walls, vertical pipes being so arranged at the centre and at the side walls as to connect the two layers of pipes.

The vertical pipes next to the walls are carried up with open ends to the top of the beds. The filling material is medium-size broken clinker, sifted so as to be free from ash, with a layer of coarse clinker over the draining pipes and over and round the aërating pipes, the tops of the beds being covered with a layer of fine ash, in which the distributing channels are formed.

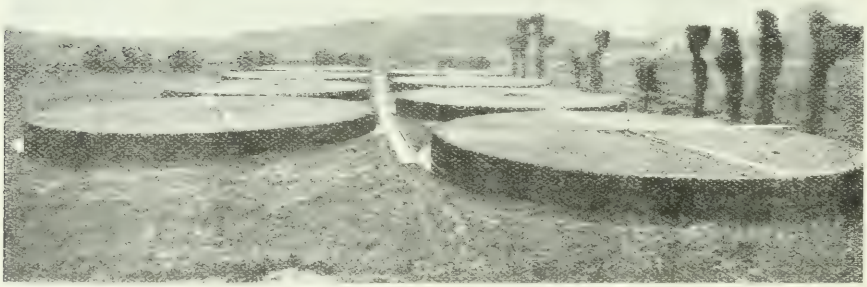


Fig. 3. View of Percolating Beds.

The beds are fed from a central channel, the inlet to same being controlled by screw-down gate valves. The liquid from the beds can either be discharged over the land for irrigation or (what is now done) on to the new percolating filters. The total cost of the work was £8,952 18s. 11d., of which £6,264 was paid for actual constructional works, £1,374 for clinker and labour in breaking, filling, &c., and £880 for 2 acres of land.

The invert level of the outlet of the beds was kept up as high as possible, owing to the contour of the ground, so as to discharge the liquid on to the land if necessary. By doing this better control and greater head has been obtained for the distribution over the percolating filters, to be described next.

PERCOLATING BEDS.

In 1907 a small percolating filter, 40 ft. in diameter,

was constructed for experimental purposes, and as it gave very good results another, of 60-ft. diameter, was laid down in the same year. The small bed was constructed in the ordinary manner, but further experiments were tried, while constructing the larger one, by gradually building up the bed in layers of about 12 in., each thickness having over the surface a thin skin of fine ash. These experiments were undertaken to ascertain at what depth a good effluent could be obtained.

In 1911 it was decided to further extend the works by putting down eight 80-ft. diameter percolating beds, with future provision for eight others.

Plans were prepared and tenders invited for the works under separate headings — filtering media, sprinklers, iron pipes and fittings, and constructional works.

The filtering medium is hard, well burnt, and vitrified furnace clinker of the sizes given below. Large, coarse gasworks clinker is used for the formation of the external walls, and is well bonded together and into the back filling.

The surface of the bottom of the beds is covered over and between the drainage tiles with gasworks clinker to pass through a sieve having square meshes of 4-in. sides, and remaining on a sieve having square meshes of 3-in. sides.

The filling material consists of selected hard-burnt destructor clinker to pass through a sieve having square meshes of 1½-in. sides, and remaining on a sieve having square meshes of ¾-in. sides.

The surface of the beds is covered with a thin layer of fine clinker passing through a sieve having square meshes of ¾-in. sides, and remaining on a sieve having square meshes of ½-in. sides. The base of the beds is constructed of concrete falling outwards from the centre to a channel at the periphery of the circle. The drainage tiles are of stoneware, some semi-circular, by Naylor, the majority being Stiff's rectangular tiles. The tiles are arranged as illustrated in Fig. 1.

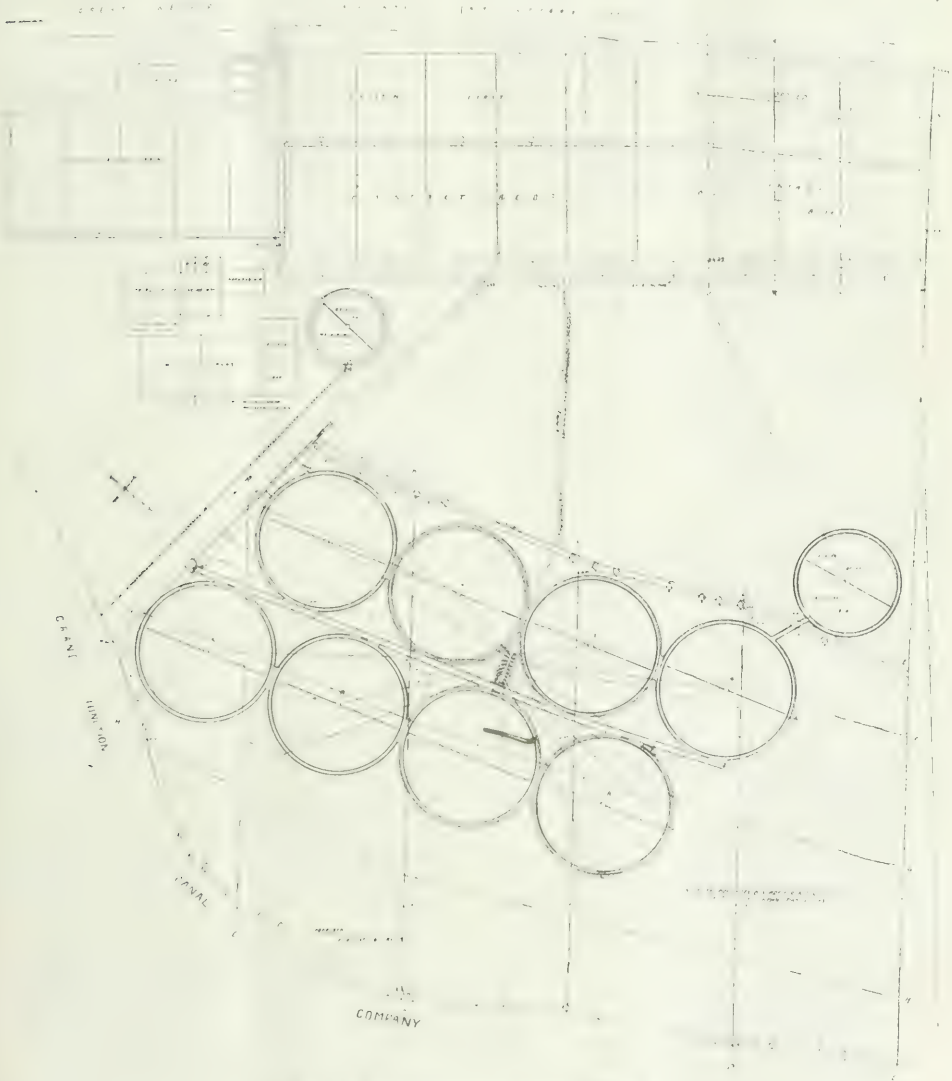


FIG. 4.—PLAN OF SEWAGE DISPOSAL WORKS.

FEEDING AND DISTRIBUTING APPARATUS.

The following description applies to the eight 80-ft. beds.

The supply to these beds is taken from an 18-in. pipe laid from the beds referred to as contact beds (now used as straining filters), with an alternative connection, by means of an 18-in. Bell mouth, to the overhead carrier referred to under tanks; this supply pipe passes directly to a chamber, shown in Fig. 2, containing the valves controlling the supply to the beds. It will be noticed from Fig. 2 that sixteen valves are fixed; eight of these are connected with

the present beds and eight are for future beds, all the pipes to which are already laid from this chamber to the outside of the existing bed, so as not to interfere with the present construction when the time arrives for extension. By means of this control chamber it is only necessary for the man to go to one spot to regulate the supply. All outlets from channels of beds into the centre channel are provided with a grooved frame to take a properly constructed rectangular measuring weir and a galvanised-iron pin is bedded in the channel, the top of which is level with the sill of the weir, so that the actual discharge from the beds may be checked. Owing to the comparative levels of the canal and the outlet from the beds it was not possible to construct a humus tank of the usual type; hence the humus is retained during the day in the channels round the beds, and washed out in the early morning into a humus tank constructed of a capacity equal to the channels surrounding the beds, and there allowed to settle, the top water being run off into the canal below the locks, and the humus discharged into the asylum tanks and dealt with as sludge. Fig. 3 shows the beds complete.

The whole of the distributing apparatus was designed by the author. The centre standard is made up of lengths of 1 ft., bolted together, with flanged joints.

The distributors were designed to give equal distribution, and capable of delivering 12½ gallons per square yard per hour under a head of 2 ft. The centre part of the apparatus was designed to utilise the head from the straining filters so as to obtain a very fine spray; hence it was necessary to have solid or sealed tops, and in place of the ordinary perforation Cainк's patent jet was used.

The author has shown in Fig. 1 the whole extent of the present works.

The cost of the eight percolating beds was as follows:—

Iron pipes	... ...	£316
Clinker		1,131
Sprinklers and pipes under beds		456
Constructional works		3,498
		£5,401

The daily dry-weather flow into the works has been checked a number of times, and the average daily dry-weather flow may be taken as 1,250,000 gallons, made up as follows:—

	Total gallons.	Gallons per head (approx.)
Due to water supply	500,000	...18 } from dis-
Due to subsoil water	500,000	...18 } trict.
Due to trade wastes	100,000	... from asy-
Due to Asylum	150,000	... 54 lum
	1,250,000	

The strength of the sewage may be gathered from the following typical analysis:—

(1) Typical analysis of mixed flow at works:—

	Parts per 100,000.
Suspended solids	25·1
Free and saline ammonia (in terms of N) ...	4·57
Albuminoid ammonia (in terms of N)	·93
Chlorides (in terms of Cl.)	34·7
Four hours' oxygen absorption ...	7·83

(2) Typical analysis of most important trade waste:—

Free and saline ammonia (in terms of N)	1·4
Albuminoid ammonia (in terms of N)	·695
Chlorides (in terms of Cl.)	232·0
Four hours' oxygen absorption ...	5·73
Ether extract (fat) ...	10·8

(3) Typical analysis of asylum sewage:—

Free and saline ammonia (in terms of N)	4·8
Albuminoid ammonia (in terms of N)	·51
Chlorides (in terms of Cl.) ...	15·0
Four hours' oxygen absorption ...	5·2

The above analyses must, of course, not be taken as applicable to all times.

In times of storm the flow has been known to increase to the rate of 3,000,000 gallons per day, spread over short periods.

TREATMENT.

The treatment of the sewage is generally carried out on the following lines:—

The combined mixture of district and asylum sewage passes through the two covered tanks near the limiting-house, and receives "milk of lime" after passing through same. The sewage, after the admixture of lime, is passed into and through the precipitation tanks in series, and the carriers between same; so that, before finally leaving the tanks, it has travelled about 800 ft., and this at a slow rate. The greatest deposit takes place, of course, in No. 1 tank, and the least in No. 4 tank.

The following shows the amount of wet sludge, in tons,* removed from the tanks from April 1, 1914, to March 31, 1915: Detritus tanks, 2,208; No. 1, 4,939; No. 2, 2,529; No. 3, 1,526; No. 4, 1,230; total, 12,432.

In passing through the carriers the sewage dissolves blocks of Spence's Alumino Ferric (A quality) placed in same.

The quantity of lime and Alumino Ferric is measured and weighed out each day, the amount used being, lime, 2·80 grains per gallon, and Alumino Ferric, 1·88 grains per gallon.

After precipitation the tank effluent passes through one or more of the old contact beds now used as straining filters, and afterwards for final purification to the percolating beds. The eight beds work an average of eighteen hours per day. The beds were started to work in May, 1912, and records of the final results of each bed, as well as the whole flow, have been kept since that date, and these show continual and consistently good results, as will be seen from the analyses given below, taken from the records at random.

Typical analysis of crude sewage, tank effluent, and final results (in parts per 100,000):—

—	Crude sewage.	Precipitation tanks.	Percentage purification on crude sewage.	Final effluent after percolating beds.	Percentage purification on crude sewage.
Suspended solids ...	25·1	2·2	91·2	1·7	93·2
Free and saline ammonia ...	4·57	1·23	—	·063	—
Albuminoid ammonia	·93	·48	48·4	·099	89·4
Chlorides (in terms of Cl.)	34·7	32·5	—	30·9	—
4 hours' oxygen absorption	7·83	5·35	57·2	·57	92·7

NOTE.—The above analyses are averages of eleven days.

The author is able to give these figures from the fact that in January, 1914, the council appointed, on his recommendation, a fully qualified chemist and manager to take charge of the sewage disposal works, under the author's control, and he would here emphasise the fact that, with the present-day requirements of sewage disposal, in his opinion it is necessary for a municipal engineer to have on his staff such an official, as from no other source can information as to the results of sewage disposal works, either controlled or designed by him, be obtained. In this official—Mr. J. H. Edmondson, F.C.S.—the author has the aid of a very valuable assistant. The cost of treatment averages between 1s. and 1s. 2d. per head of population per annum.

The quantity of sewage effluent dealt with by the percolating beds may be taken to be at the rate of 160 gallons per cubic yard, or 240 gallons per square yard per day of twenty-four hours during dry weather, or 213 and 320 gallons respectively calculated on actual work.

SLUDGE.

The sludge from the precipitation tanks is pressed by means of three filter presses (the press-house being extended and two additional presses added in 1912), and that from the detritus tanks is usually passed on to the farm. The quantity of wet sludge dealt with by presses during the year ended March 31, 1915, was 7,608 tons, and the quantity of pressed cake produced may be taken as 1,600 tons. The percentage of lime added for pressing is 4·5 on the pressed cake, or ·92 per cent on the wet sludge, and the cost of pressing averages between 2s. 4d. and 2s. 6d. per ton of pressed sludge.

A Glossary of Road Terms (By H. Percy Boulnois, M.INST.C.E., St. Bride's Press, Limited, 24 Bride-lane, E.C., Price 2s. nett).—The movement towards standardising the principal roads throughout the United Kingdom has rendered it necessary to correlate the nomenclature of road terms in use in different districts, and Mr. Boulnois has compiled a glossary with the hope that it may form a basis for such a correlation.—*Times Engineering Supplement.*

* The weight is calculated on the assumption that 1 gallon of sewage weighs 11 lb.

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING IN LONDON—(6).

Of the papers submitted at the recent annual meeting of the Institution of Municipal and County Engineers was one by Mr. H. P. Wakeford, surveyor to the Ilkeston (Derbyshire) Corporation, dealing with

EXPERIMENTS IN SEWAGE PURIFICATION BY FORCED AERATION.

The paper, which is reproduced elsewhere in this issue, was followed by discussion.

Mr. A. T. Goodman (Wembley), the first speaker, said he thought Mr. Wakeford should be congratulated on being the first member to bring this interesting subject of forced aëration before their institution. On these experiments he should like some more information. Mr. Wakeford said it should be possible to purify sewage in tanks having a capacity of five or six hours' flow of sewage. It seemed to him then that some very important words were left out, for there was no reference to the dry-weather flow. If it did not mean dry-weather flow they would have to multiply those figures by three for tank accommodation. In addition to that, in the tank accommodation they would have to add 25 per cent. to the activated sludge. Therefore they were getting to a very big tank accommodation, instead of a smaller one. Then, in stating the advantages as to reduction in capital cost and in maintenance, Mr. Wakeford seemed to be very optimistic. With the information at their disposal he did not know how Mr. Wakeford had come to all the conclusions he had. Mr. Wakeford claimed that one of the advantages of this system would be that the smell would be decreased. He very much questioned that. Could they imagine the working of this system on a large scale, and 1,000,000 gallons of septic sewage being blown up? Could they not imagine the terrible smell that would occur? Mr. Wakeford also said that it would be very much less costly. At the present stage he should very much doubt that. With the introduction of pipes, compressors and pumping machinery he was very doubtful whether the cost would be reduced. It had occurred to him that the salvation of the system might be in the increased manurial value of this activated sludge, but Mr. Wakeford did not put the value on the sludge which he had done. Mr. Wakeford said, "the sludge being of higher manurial value for agricultural purposes, doubtless the revenue derived from its sale would at least meet the cost of its removal." He was disappointed in that, because he had heard somewhere that they might get £2 10s. per ton, which might do away with some of the increased cost. It seemed to him the system was a very excellent one, but it had come about two decades too late.

Mr. REGINALD BROWN (Southall-Norwood) remarked that up to the present probably the whole of the experiments had been carried out by chemists in the laboratories. Now they had a member of the institution who had put down tank accommodation in his own works to deal with a rather difficult sewage by this process. The paper, of course, brought out nothing new on the subject. Originally the system was suggested by Dr. Fowler on a visit he paid to the United States, and many of the experiments were brought out by Messrs. Ardern and Lockett in a paper before the Manchester section of the Society of Chemical Industry last year. He did not quite agree with the last speaker that it was too late for such a scheme to be brought forward; nothing was too late in the advance of municipal engineering. There was no doubt that the paper would give them a tremendous amount of thought, because there was a lot in what Mr. Wakeford said. If the results in practice turned out equal to the results as shown in the paper, they had before them a remarkable and a cheap method of sewage disposal. He said if, because it was a small word with a big meaning. There was still a tremendous amount of work to be done, and Mr. Wakeford himself pointed out that, even with his small experiments, there were a large number of engineering difficulties to be overcome. Those who had read Messrs. Ardern and Lockett's paper would see that the different classes of sewage required a varying amount of aëration. At Manchester it was estimated that the sewage would take eighteen hours' aëration before it was completely nitrified. Now, in that case one would be able to do without bacterial filters altogether. With six hours' aëration they would get sufficient purification to be able to pass the effluent at a rapid rate through a percolating filter. That was what Dr. Fowler aimed at. Messrs. Ardern and Lockett went further and tried an amount of aëration by which they could do without a percolating filter. It seemed to him the system was an application of their present methods. They first swore by land as the most efficient treatment, and then proceeded to percolating filters and contact beds; now it was forced aëration. It was a question, of course, as to what the scheme was going to cost. He would like to mention one or two points in connection with the difficulties. They had first of all the different strengths of sewage. Sewage, as they knew, differed in strength at almost every minute of the day, and if they got a class of sewage coming in one hour which was of an exceedingly strong nature it would require very different treatment from a weak sewage which went in at another hour. Then there was the question of storm water. Then, again, they had to decide whether the tanks should be open or closed; because, after all, temperature had a very great effect on the results. The previous speaker had mentioned a most important item which affected the cost—the size of the tanks. They had to provide in this system for the sludge occupying 25 per cent of the tank capacity. The most important point was the construction of the floor. Mr. Wakeford had said, he thought quite rightly, not only from his own experiment, but from the chemists' experiment, that they must have a floor in these tanks by which they would be able to diffuse the air through the whole of the sewage. That was a most difficult thing to get, and that was where the cost would come in. Then, again, they had to decide as to the tremendous amount of air that would be required to do the necessary work. Then they had also to consider the maintenance of the activated sludge itself—whether this was not affected by the fluctuating character of the sewage and the degree of aëration. Mr. Wakeford did not mention the question of what he thought would be the cost of the application of this method. He remembered a remark of his on Messrs. Ardern and Lockett's paper, that the cost of treating the sewage at Wakefield by lime treatment was put at 17s. per 1,000,000 gallons, and that he did not see why by aëration it should cost more than 10s. per 1,000,000 gallons. If they added to that the cost of the necessary works it would bring the cost up to what they were at present put to by properly constructed percolating filters. Then, again, as to sludge. Activated sludge contained a considerable amount of moisture over and above that in settled or precipitated sludge. Mr. Wakeford's figures showed 96·73 per cent of moisture in it as compared with 90 or 91 per cent in precipitated sludge. If that were so, they would have to make bigger provision for it. Messrs. Ardern and Lockett suggested that the water could be removed by passing it over fine straining filters. He suggested that Mr. Wakeford should try to get rid of it by the vacuum process. He would be using compressed air, and if he would utilise the same machine for making a vacuum he would get rid of his moisture quickly and cheaply. The most important question was the results. He could not quite see from the diagrams why Mr. Wakeford should suggest they should go to two hours' aëration. By the diagram he showed he got a tremendous purification—he was referring now to the four hours' oxygen absorption test—by one hour's aëration. In the table given in the paper he showed 75 per cent of purification up to one hour, and that by doubling the expenditure he would only get another 9 per cent of purification, and with another doubling only an additional 3 per cent of purification. Why not stop after one hour and pass it through percolating filters? He had tried a certain amount of experiment in this system, and he could only get with six hours' aëration 79 per cent of purification on the oxygen absorption figure and 59 per cent on the albuminoid ammonia figure; and after eight hours' aëration 88 per cent on the oxygen absorption figure and 60 per cent on the albuminoid ammonia figure. It was perfectly correct that if this system was to be adopted it would be compulsory for every municipal engineer to have on his staff a qualified chemical assistant, because this system could not be worked at all without having a chemist in charge.

Mr. John D. Watson (Birmingham) thought Mr. Wakeford had done excellent work in bringing this question before the institution. He had done his subject justice, and had obtained results similar to those which other experimentalists had obtained by working on similar lines. Mr. Watson took exception, however, to some of the conclusions which Mr. Wakeford had drawn from the data he had presented in the paper. He did not say that these conclusions were wrong, but he did not say that Mr. Wakeford had no means of judging whether they were right or whether they were wrong, and Mr. Wakeford had not in the paper itself given the means of judging whether they were right or whether they were wrong, and he ventured to think that Mr. Wakeford would probably modify some of his conclusions as his experiments developed. Mr. Wakeford had not dealt with the all-powerful question of cost. All engineering practice resolved itself into pounds, shillings and pence, and after he had developed the experiments which he had so well begun he hoped he would give them a second paper in which costs would take a prominent place. Mr. Watson also hoped that either Mr. Wakeford or someone else would be bold enough to inaugurate this forced aëration system, where the fluctuating flow of sewage from an ordinary town, however small, had to be dealt with. He thought it might be taken for granted that the process which had been described was one which was capable of giving quite good results. It was a natural process; but he was bound to conclude that Nature had been forced, and he doubted whether the best results could be obtained by thus forcing Nature. It was now well known that the biological principle of sewage purification was to bring the impurities into contact with bacteria, which perform their functions in the presence of air. By the process Mr. Wakeford had brought before them the organisms were first cultivated in sludge, and then by air under pressure they were thrown up against the impurities in the sewage. In that way the impurities came in contact with the nitrifying and other bacteria. This was done many times. He did not know how many, probably thousands of times, and after a number of hours' air blowing—the time varying with the character of the sewage dealt with—they were said to obtain a purification which admitted of the liquid being allowed to flow into the stream. The diagram showed how quickly the change took place. This process must inevitably be contrasted with bacteria beds as they were now constructed. If they brought sewage by gravitation, and distributed it also by gravitation over the surface of the bed, it would percolate through the accumulation of stone or other material employed as purifying medium. The air was thus obtained naturally. The interstices of the medium thus filled with air formed a lodgment for the bacteria, and, as the sewage trickled from the surface to the bottom of the bed, purification took place. It seemed to him that by this forced aëration process—although it produced quite good results—they were working under a tremendous handicap. They were forcing Nature into methods in which she would rather not enter. This might be done as an experiment, but he questioned whether it could be kept up as a continuous process. As Mr. Brown had said, a town sewage was constantly changing, and if they had in their sewage as it arrived at the outfall works acid or tarry substances they would probably find those substances would inhibit the whole of the organisms, and he understood it took about eight weeks to activate this sludge into such a state that the organisms were sufficiently active to deal with impurities in the sewage. In the previous week's Surveyor he noticed that at Walsall they had had considerable trouble owing to acids having been discharged into the sewers, thereby endangering the purifying power of the sewage purification plant. That kind of thing would happen, and if they were to construct works which would give the least possible trouble, and provide the greatest elasticity for meeting unforeseen discharges of antiseptic wastes, he thought they would have to avoid as much as possible those exceedingly clever and novel methods of purification which some of them were tempted to strive after. Speaking of the variation in sewage, he had occasion some time ago to pump a sewage which varied a good deal in character, and he had to do it with a centrifugal pump, the impellers of which had to be changed every five months, as they were reduced to about one-half their original weight in that time, probably as the result of contact with an acid waste, and still more recently he had had difficulties with sludge which was being dealt with on biological lines, and depended to a very large extent upon fermentation for the elimination of objectionable smell. Discharges into the sewers of the residuals of coal-gas products had the effect of inhibiting the whole of the organisms, with the result that the stench was unbearable. In considering this question of forced aëration, they should not forget that it was not exactly a new process. It must be thirty years since Dr. Angus Smith, the well-known chemist, made a report to the Local Government Board on the subject of deodorising sewage by blowing air into it, and he pointed out that a certain amount of purification took place, and that putrefaction was retarded as a result of the process. Since that time they had had many good men experimenting with the subject. Du Pre, Dibdin, Lowcock, and others whose names he could not recall. Recently the subject had been gone into more fully by Mr. Clark, the chemist to the Massachussetts State Board of Health. Still more recently, Dr. Fowler had studied it, and as the result of that study had advanced it considerably. This has been followed up by Messrs. Ardern and Lockett, and they should not forget Mr. Wakeford. Now, what was all this coming to? Could they say that this was a system which ought to be adopted in the majority of cases in England? The Royal Commission had only the other day issued their Final Report, after having sat for seventeen years, and they had not even mentioned this as a practical system. Mr. Wakeford had done the right thing in bringing the matter forward for discussion, and in ventilating it to the fullest extent; but they should be careful not to exaggerate claims that were not fully proved, or to bring them prematurely before the public. If the Local Government Board were to look favourably upon this system it might have the effect of inducing them to shorten the loan period, on the ground that sewage purification methods were changing so constantly that short periods were inevitable. Personally, he did not think we had come to that yet, but he doubted the wisdom of emphasising experiments of this kind unduly. If he had had time he would have liked to refer to a pamphlet issued by a firm who had done a great deal of excellent work in sewage purification. It was termed "Sewage Purification by Aëration and Activated Sludge." He observed from this pamphlet that a patent had been taken out for the process. This raised a question whether manufacturing engineers were justified in taking out patents which would probably have the effect of limiting and strangling further experiments. Without expressing any opinion as to whether this course was legal, he felt that it was not in the best interests of municipalities that patents protecting processes should be taken out. This did not apply to patenting mechanical devices which contributed to the success of a process; but, so far as he could see, to patent a process itself was calculated to put back the hands of the clock.

Mr. E. H. Crump (Hinckley) said he should like to add his thanks to Mr. Wakeford, as his paper was most interesting to him, inasmuch as at the Hinckley sewage works he treated the whole of the sewage—about 500,000 gallons per day—by this aëration process. Perforated pipes were fixed about five years ago near the bottom of each settling tank, and the sludge was activated or blown up by means of compressed air after each tank was full, and mixed up with the sewage. The blowing up of the tank, unlike Mr. Wakeford's experiments, was only continued for about twenty minutes, and then settlement of the sewage was allowed to take place for about 1½ hours; then the sewage, or effluent, as it might be called, was drawn off by means of floating arms previous to being pumped for land treatment. He must, however, state that this aërating system was not installed in the first place—five years ago—with any idea of purification being effected, but with the object of clarifying the sewage, which for the greater portion consisted of dye waste containing an excessive amount of flocculent and other suspended matters, and to which lime had to be added at the rate of about 20 grains per gallon, and it was only within the last two years that Dr. Robinson, the county medical officer of Leicestershire, and himself perceived that a certain amount of purification—in addition to the clarification—was also being effected. Unfortunately, having to use the same air compressors for blowing up the sludge as are used for working the ejectors for pumping the sewage after settlement, they were not in a position at present to continue the aëration of the sewage for two hours, as suggested by Mr. Wakeford, but could only blow up for about twenty minutes; but there was no doubt in his mind that a greater degree of purification would be effected if longer aëration were carried

cast. They at Hinckley could claim, however, that they had one of the first, if not the first, sewage works, the whole of the sewage of which was being treated by the aeration process, and from a few analyses they had proved to some extent that the purification as shown by Mr. Wakeford's experiments was effected. Of course, difficulties presented themselves as in all other cases, and these appeared to him to be as follows: (1) Additional tank accommodation must be provided to allow for the time the existing tanks are being aërated and allowed to stand for settling purposes; (2) the question of the sludge accumulating in the tanks is another point, for if a certain quantity of sludge be not removed periodically the capacity of the tank will naturally become considerably decreased. At Hinckley a certain amount was removed weekly; (3) that if the sewage contains dye liquor or similar waste of a very high colour, the aërating process, although clarifying and purifying the effluent to some extent will not remove the colour, and some preliminary chemical treatment, or some after treatment, must be provided for this purpose. He would like to hear Mr. Wakeford's opinion on the points of tank accommodation, the sludge and the colour difficulties he had mentioned. The diffusing of the air by means of the perforated pipes at the bottom of the tanks at Hinckley was quite successful, and created a thorough disturbance in the whole of each tank; but they, of course, used a greater air pressure than that mentioned in Mr. Wakeford's paper; but, of course, there was a considerable smell. He thought, however, it would be interesting to members to know that they had proved by actual experience to some extent the facts mentioned by Mr. Wakeford, but owing to not being allowed to engage a resident chemist for analyses, he had not been enabled to carry out experiments in such a degree as he should have liked. There was, he believed, a great future for this aërating process, but he did not think it could be yet safely assumed that no further treatment after aëration of the sewage would be necessary, as some experts said. Nevetheless, he was convinced that, with sufficient aërat on, additional tank accommodation to allow for settlement, &c., if after treatment was required there would be a very large decrease in the filtration area to be provided than what was now necessary after ordinary tank treatment.

Mr. C. H. COOPER (Wimbledon) said it was only in February that he heard of activated sludge, and it appeared to him that it was a very crude way of mixing air with the sewage. A better method of applying the air would seem to be by means of an atomiser. He had tried it, and had certainly got good results, although the experiment was, of course, only on a small scale. He had had very good results with the ordinary oil atomiser which was used in oil furnaces. He had never had activated sludge to work with, nor did he intend to work with it; what he intended to do was first to pass the sewage through a large atomiser and then have others fixed at various stages along the channels. He understood that where experiments were being carried out the difficulty was to keep the floor clear, but with an atomiser they had nothing to keep clean.

Mr. E. B. MARTIN (Salford) said he was rather disappointed with the paper, as it was written purely on chemical lines rather than with regard to the engineering difficulties. He had been associated recently with Mr. Melling in carrying out the largest experiment on this system in the country. Mr. Melling was at present treating 200,000 gallons per day, and the results he had got were such as to prove that sewage could be treated in this way. As to engineering difficulties, he had jotted down two or three. There was the point Mr. Watson mentioned of the constant change of the quality of the sewage going into the tanks. They had experienced that on several occasions. They had a tank of 22,000 gallons, and he believed that 25 per cent of its capacity was taken up by the activated sludge. That tank was filled, and immediately the sewage began to flow into the tank blowing commenced, and after it was full the blowing continued for anything from one to twelve hours. They had had perfect results after one hour's blowing, but at times, if there was tarry matter in the sewage, it took twelve hours to obtain the same results, owing to the inability of the bed to deal with the sewage. In addition to the difficulty of the variation in the quality of the sewage, there was the huge and insuperable difficulty of the variation of flow. It could to some extent be got over by varying the flow of air to the tanks, but not entirely. It did seem to him that to have a big installation with no other stand-by but these tanks would be skating on thin ice. If they were going to make a proper use of this system they should use aëration to deal with, say, twice their normal flow, and their filters for the balance. One of the chief difficulties was to get at reliable statistics. The experiments which had been exploited in the country at present were only toys. They were quite small, with one or two exceptions, and statistics were not yet obtainable. As far as he was able to obtain figures, 80 cub. ft. of air were required per cubic foot of sewage treated. That was sufficient to enable one to calculate the cost. The figure of 80 could, however, be reduced considerably, and they were now considering an offer by a firm to supply a tank with a continuous flow of about 500,000 gallons a day, with a guarantee of 4 cub. ft. of air per cubic foot of sewage. He did not think there was a reliable air meter on the market, so that it was extremely difficult to know what quantity of air was actually used. Measurement by piston displacement was absolutely unreliable. The second difficulty was in connection with diffusion. When they realised that for every extra 1 lb. of air they were adding 16 per cent to the power necessary to compress it, they would see how important it was to find some sort of diffuser through which air could pass without letting the sewage through. In his opinion there was a future for this aëration process of sewage treatment; but his experience as an engineer was that the sewage question had been solved twenty times in the past, and the results had been to many disappointment. They could see most extensive installations of machinery, the only benefit of which had been to the contractor who fixed it and the consulting engineer who advised it to be put there.

Mr. E. J. SILCOCK (Westminster), in a written communication, said the process of sewage purification described by the author of this paper is one of great interest, but he must confess to some disappointment to find that the author had not carried the subject any further than the Manchester experiments. Those experiments appeared to settle the principle that sewage can be oxidised by blowing air through it in a comparatively short time by the addition of activated sludge. Previous experiments had shown that air alone would purify sewage, but the process was so slow as to be impracticable. Probably the Manchester experiments had brought the system within the range of practical work, but it now remained for the engineers to devise the necessary mechanical devices to apply the principle on a sound working basis, and it would then be the financial results which would largely determine whether the system could be adopted to any large extent. Any system of purification which avoided a putrefactive process and which facilitated the drying of sludge was bound to appeal to the imagination and stimulate experiment, quite apart from the fact that such a process could take place on sites where the systems already in vogue could not possibly be allowed. The advantages claimed by the author for the new system were not all by any means certain of attainment, and must, at least temporarily, be accepted with reserve. For instance, with regard to capital cost, it should be pointed out that until a continuous system of tankage was devised it would be very unwise to calculate on a five or six hours' storage being sufficient. In order to accommodate the variations in rate of flow even in dry weather on the "fill-and-draw" system at least twelve hours' storage would be required, and to deal with storm water a great deal more would be needed. Again, although filters would not be required, this expenditure might be balanced by the additional cost of machinery. Then, too, the author enumerated those grounds on which the maintenance costs would be reduced; but these would certainly all be far exceeded by the additional expenditure for air pumping. Generally, the system appeared to be one well worth following up, but its future depended entirely upon the success of mechanical details of economy in working.

Mr. WAKEFORD, in reply said the purification of sewage by forced aëration had been demonstrated by Dr. Fowler as a scientific fact, and the purpose of the experiments at Wakefield was mainly to make observations on the treatment of a complex sewage on the principles established by him, and from an engineering point of view to obtain a better knowledge of some of the difficulties to be overcome in applying the new system on more extensive lines, but he did not claim to have solved any of these difficulties. The object of these notes was to arouse the interest and secure the co-operation of engineers in further experimental work on a considerably large scale, which, if successful, would undoubtedly prove of great value

in the design of new disposal works, or the adoption of the system to existing conditions. One point to which he should like to direct attention was the high percentage of nitrogen in the sludge as compared with ordinary precipitation or settled sludge. As would be observed from the tables, the activated sludge contained 4·59 per cent of nitrogen, and ought to be worth £4 10s. per ton, consequently its value was greatly enhanced as compared with the usual forms of sludge produced. Another point worth noting was that the percentage of air purification was highest in its initial stages, and for this reason it is probable that greater economy would result by utilising the same as a preliminary to the discharge of the sewage on to existing filters at a much higher rate than has yet been possible. He was quite aware that attempts at purification by air were not new, but such attempts appear to have been of little practical value owing to the slowness of the process; but the treatment by means of forced aëration, in conjunction with activated sludge, is a marked advance on all previous efforts in this direction, and might be regarded as the nearest approach to ideal conditions yet devised. If sufficient money and energy were expended on this aëration principle, it is possible that the numerous engineering difficulties in the application on a really large working scale might be overcome, and if it could be shown conclusively that such larger experiments give results equal to those dealing with smaller volumes he considered there would be ample justification for assuming that disposal works could be designed which would possess the advantages set forth in the notes.

(To be continued.)

LOCAL AUTHORITIES' EXPENDITURE.

EARL WINTERTON'S QUESTIONS.

In the House of Commons on the 22nd inst. Earl Winterton asked the President of the Local Government Board if he was aware that, despite the recent appeals of the Prime Minister and the Chancellor of the Exchequer, a vast number of local authorities throughout the country had made no effort to cut down their peace time expenditure, and that money was being spent on tar-paving of school playgrounds, a provision of motor cars for surveyors and architects, street improvements, bands, bandstands, and many other objects not essential to sanitation and public health; and whether, in view of the admitted inability of the members of these bodies to realise the need of war economy and the powerlessness of the Legislature to control them effectually, he would introduce legislation to curtail drastically their spending powers during the period of the war.

Mr. Jonathan Samuel said that before the question was answered, he would like to ask whether the noble lord was in a position to know what local authorities were doing at present in this respect.

Mr. Long said he was aware that in some cases expenditure which was not absolutely necessary was still being incurred, but he was doing his best to check it. He did not think it was necessary to introduce legislation for the purpose.

Electric Cookers for Workmen's Dwellings.—The installation of electric cookers in some of the workmen's cottages of the Barnes Urban District Council has been decided upon. The type of cookers recommended for adoption cost £4 each, this sum including all wiring, the supply of accessories, and fixing. The life of the cooker is put at ten years. On this basis it would, according to Mr. C. S. Davidson, the council's electrical engineer, be necessary to impose a rent charge of 10s. 4d. per annum, which would be sufficient to pay the interest on capital expenditure at the rate of 5 per cent and redeem the whole of the capital in the period mentioned. The consumption of energy is estimated at 624 units per cooker per annum, this figure being based on a summer consumption of 18 units per week and a winter consumption of 6 units per week. An imposition of ¼d. per unit on this consumption would return 13s. per annum, which is sufficient to meet the interest, redemption, and maintenance charges. It is therefore proposed to charge the consumer at the rate of 1d. per unit, a figure which, after deducting ¼d. per unit to cover the outlay of the Public Health Committee, would leave ¾d. per unit for the supply, including meter rental.

COUNCILLORS' QUESTIONS.

REDRUTH SURVEYOR'S PROTEST.

In the course of the last meeting of the Redruth, Cornwall, Urban District Council Mr. Samson asked if it was true that the stoppage of the pump at the reservoir was due to inferior oil and anthracite. He had been informed that was the case.

The surveyor (Mr. H. Monson) replied that they had been using the oil for two years, and it had been all right until lately. He had written the firm concerning the anthracite, and they were unable to explain why it had fallen off. It was a strange thing why members should be permitted to go to the pumping station and question the employees. If they came to him he could give all the information needed.

Mr. Trestrail said he did not agree with the method of procedure at all. Members should go to Mr. Monson instead of questioning subordinates. Such trivialities were outside the business of the council, and if he were the surveyor he would dismiss every employee who was given to talking, and would have men under him whom he could trust.

Mr. Lanyon and Mr. Chandler concurred, the latter remarking that the men themselves could not be blamed.

The chairman was glad the discussion had arisen, for he disapproved of the manner in which the surveyor was plied with questions in open council.

CORRESPONDENCE.

Εις ἀνηρ ὸυ πάνθ' ὁρᾶ

(One man does not see everything.)

—Euripides.

"WATERWORKS ENGINEERING."

To the Editor of The Surveyor.

Sir,—I regret to say that I have only just discovered in the chapter of the above work devoted to the design of high masonry dams an important printer's error on p. 10.

Rule 3, p. 10, should read that $Y = \frac{5}{10}x$ up to 100 ft. in depth—not $\frac{1}{10}x$, as stated.

As it is impossible to ascertain individual purchasers of copies in this country, in America, Australia, Africa and Egypt, I should feel indebted by your giving prominence to this correction.—Yours, &c.,

F. C. Uren.

Municipal Buildings,
Aldershot.
July 27, 1915.

AN APPEAL.

To the Editor of The Surveyor.

Sir,—I have been advised by Messrs. Dodd & Dodd, of Corporation-street, Birmingham, to write you, and state that my husband, late surveyor of Tamworth, Staffs, died on June 4th, after a severe illness, and left his widow (myself) and young son, three years old, utterly unprovided for. He was a member of the Royal Sanitary Institute and of the Institution of Municipal and County Engineers. He was fifty-one years old, and was formerly surveyor of Trowbridge, and thirteen years at Tamworth. The furniture was sold, also his salary was kept, and the balance in bank, to pay bills owing of which I knew nothing. He had made no will, neither was he insured. I came home to my father with £5 the corporation allowed me out of his salary as I had nothing. My father cannot keep me. He is seventy-three. I shall try to get a post as housekeeper, but in the meantime I do not know what to do.

Could you assist me in placing my boy in a home and school? He is such a baby at present. I would like, if I could possibly, to keep him with me another year. I have never been parted from him yet. My own health is not robust, but I must do whatever is best for my boy. The corporation have sent me a letter of appreciation of my husband's services, if you would like to see it. One does not stand much chance of getting anything to do in a country place. —Yours, &c.,

Lilian Bradshaw.

Ham House,
Holt, Wilts.
July 4, 1915.

[The case of Mrs. Bradshaw has been recommended to our notice, and is both genuine and deserving. If any of our readers are able to assist in the direction indicated in her letter we shall be pleased to act as intermediary in the matter.—Ed. Surveyor.]

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

494. Strength of Pillar.—A solid, square pillar, 10 ft. in height, with a section 2 ft. by 2 ft., and weighing 50 cwt., is subjected to a horizontal wind pressure of 28 lb. per square foot on one side. Assuming its material to be uniformly elastic, find the intensity of compressive stress at the leeward edge and at the windward edge of its base.

495. Radius of Gyration.—Explain from first principles the precise meaning and significance of the term "radius of gyration" as used in the investigation of the theory of beams.

496. Stand for Procession.—A stand with seats is required, from which to view a procession, upon a site 40 ft. by 10 ft. The front is to be 4 ft. above pavement behind some iron railings. Give section and part plan to a ½-in. scale.

497. Gauging Sewers.—Describe a suitable method for gauging the flow of sewers.

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

493. Theory of Beams.—A girder is continuous over two spans of 20 ft. and 15 ft. respectively. What are the relative reactions of the three supports? (Inquirer.)

In the case of a continuous beam, the general case of Clapeyron's Theory of Three Moments states that

$$M_a l_1 + 2 M_b (l_1 + l_2) + M_c l_2 = 6 \left(\frac{s_1 y_1}{l_1} + \frac{s_2 y_2}{l_2} \right)$$

where M_a is moment at support A (Fig. 1)

M_b ,, ,, B

M_c ,, ,, C

l_1 is distance from A to B

l_2 ,, ,, B to C

and if A D B, B E C be the free bending moment diagrams for spans A B, B C, F, G, their respective centroids and s_1, s_2, their respective areas

y_1 in formula is distance of F from A (Fig. 2)

y_2 ,, ,, G ,, C

As the question does not state any particular loading, assume the girder to be loaded with an intensity of w tons per foot run.

In this case, the theorem states that

$$M_a l_1 + 2 M_b (l_1 + l_2) + M_c l_2 = \frac{w}{4} (l_1^3 + l_2^3)$$

∴ By substitution, we have

$$20 M_a + 70 M_b + 15 M_c = \frac{w}{4} 20^3 + 15^3) = \frac{11375}{4} w$$

FIG. 1.

But it is evident that since A and C are not fixed, $M_a = M_c = 0$

$$\therefore 70 M_b = \frac{11375}{4} w$$

$$\therefore M_b = \frac{11375}{4 \times 70} w = \frac{325}{8} w \text{ ft. tons}$$

From this we can obtain

Reaction at A $= \frac{w l_1}{2} + \frac{M_a - M_b}{l_1} = \frac{20}{2} w - \frac{325}{20 \times 8} w = 7\frac{1}{2} w$

Reaction at B $= \frac{w l_1}{2} + \frac{M_b - M_a}{l_1} + \frac{w l_2}{2} + \frac{M_b - M_c}{l_2} = \frac{20}{2} w + \frac{325}{20 \times 8} w + \frac{15}{2} w + \frac{325}{15 \times 8} w = 22\frac{23}{24} w$

Reaction at C $= \frac{w l_2}{2} + \frac{M_c - M_b}{l_2} = \frac{15}{2} w - \frac{325}{15 \times 8} w = 4\frac{19}{24} w$

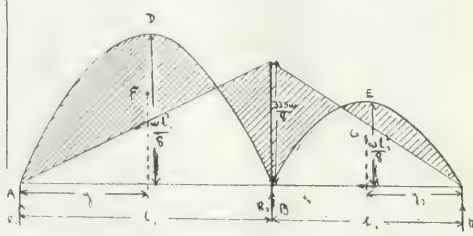


FIG. 2.—BENDING MOMENT DIAGRAM.

We see that $w (7\frac{1}{2} + 22\frac{23}{24} + 4\frac{19}{24}) = 35 w$ = total load on beam, thus checking the working.

Thus at A the reaction is equivalent to $7\frac{1}{2} w$

,, B ,, ,, ,, $22\frac{23}{24} w$

,, C ,, ,, ,, $4\frac{19}{24} w$

w = load in tons-foot run.

We can plot the bending moment and shear diagrams for the girder from the above data if required, and the theorem is applicable to any form of loading or span.

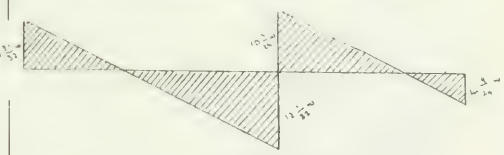


FIG. 3.—SHEAR DIAGRAM.

It is assumed that the three supports in this query are all on the same level, as it is evident that should this not be the case the whole of the reactions would be altered. (B. K., *Newport.*)

Bills in Parliament.—During last Session there were dealt with by Parliament no fewer than eighty-six Government public Bills, of which the whole, with three or four exceptions, have been carried to a successful issue and the Royal Assent signified. The number of private Bills was considerably less than the public ones—viz., sixty-nine—and, with very few exceptions, these have become law. In addition, forty-three Provisional Orders Bills have been passed – a grand total for the Session of something like 200 Bills. The number of private schemes submitted for consideration was, owing to the war, naturally much smaller than is usual.

Expenditure on Main Roads.—On Tuesday, in the House of Commons, the President of the Local Government Board was asked whether he had any authority over county councils in respect of their expenditure upon main roads directly under their control, and, if so, whether he exercised or was prepared to exercise such authority in order to prevent the continuance of excessive expenditure, at any rate during the war. The Parliamentary Secretary to the Local Government Board, Mr. Hayes Fisher, who replied, said that, except as regarded expenditure proposed to be defrayed out of loan, the President of the Board had no authority other than that involved in the audit of the accounts of these councils.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Falmouth T.C. (July 23rd. Mr. P. M Crosthwaite). £2,180 for the enlargement of the cemetery, £1,050 for the purchase of the Penwerris site for a burial ground, and £320 for carrying out the Market Strand drainage scheme.—It was stated that the drainage scheme had been before the council many years, and the application to borrow the money to carry out certain works was made as the result of complaints by owners of property adjoining. The council did not feel this was the time to go in for a complete scheme, but the work proposed would do something to remedy the cause for complaints. The municipal officials present included the borough surveyor, Mr. H. E. Tresidder.

Sheffield T.C. (February 22nd. Mr. G. L. Pepler). —This was an inquiry into an application under the Housing and Town Planning Act for authority to prepare a town planning scheme in an area on the north-west of the city, including Hillsbro', Crookes, Malin Bridge, and parts of Wadsley Bridge and Stannington.—The town clerk, Mr. W. E. Hart, stated that the corporation had already obtained powers in respect of nine planning schemes, and the present one comprised about 1,370 acres, including practically the whole of the unbuilt area therein. The improvements surveyor, Mr. E. Partington, said the city contained 12,379 acres of land suitable for town planning, and they had now 9,000 acres of it under consideration. In localities adjoining the area there had been several instances of a higher rate of density of dwellings, and the corporation desired to check the tendency. The present individual and haphazard method of developing land would be repeated unless the corporation stepped in. There was no opposition.

APPLICATIONS FOR LOANS.

Aberystwyth T.C.—£300 for the provision of a rifle range.

Branston R.D.C.—£2,000 for a sewage disposal scheme.

Bridlington T.C.—It was reported by the town clerk on Wednesday that the Provisional Order relating to the acquisition of the New Spa had been confirmed by Parliament, and the council passed a resolution instructing the town clerk to apply to the Local Government Board for their consent to purchase, by agreement, for £16,000, the New Spa undertaking, and to apply to the Local Government Board for sanction to borrow that amount for the purchase of the New Spa. The town clerk was also instructed to apply to the Treasury for its consent to the borrowing of £16,000.

Burton T.C.—£400 for works of sewerage.

Bury T.C.—£7,500 for the electricity undertaking.

LOANS SANCTIONED.

Burnley R.D.C.—£130 in respect of excess expenditure on the Foulridge sewage works.

Colwyn Bay UD.C.—£600 for the purchase of land for a service reservoir and pleasure grounds.

Darlington T.C.—£26,000 for the electricity undertaking.

Islington B.C.—£20,919 for the purposes of electricity and paving.

Farnham U.D.C.—£15,240 for sewage disposal works.

Tamworth T.C.—In the course of Wednesday's meeting a letter was reported from the Local Government Board, stating that they had had under consideration the report of one of their inspectors, after an inquiry held by him with reference to the application of the council for sanction to borrow £15,000 for the purpose of a scheme for the provision of working-class dwellings under the Housing of the Working Classes Act, 1890. The board had been in communication with the Treasury, and they were prepared to sanction a loan for the minimum amount necessary to provide twenty-four houses, on the council's plan "C," on the understanding that the expenditure would be spread over as long a period as was reasonably possible. The council should now advertise for tenders for the erection of twenty-four houses referred to, and furnish the board with a statement showing the amount required, and how it was made up. Instructions were given to the Sanitary and Streets Committee to take the necessary steps to obtain tenders.

FORTHCOMING INQUIRIES.

AUGUST.

		£
3.—	**Huntingdon.** For a housing scheme (Mr. H. A. Chapman)	10,000
4.—	**Audley.** For works of sewerage (Mr. R. H. Bicknell)	1,300
4.—	**Pontypool.** For the provision of slaughter-houses and stabling (Mr. F. H. Tulloch)	4,000
5.—	**Gosport.** For the purposes of the sewage pumping station (Mr. R. H. Bicknell)	3,800
5.—	**Irlam.** For works of sewage disposal (Mr. A. G. Drury)	15,900
6.—	**Kiveton Park.** For works of sewage disposal (Mr. A. G. Drury)	—
10.—	**Sheffield.** For the purposes of fire station extension (Mr. F. H. Tulloch)	4,067

PERSONAL.

Mr. W. Newton, highways surveyor to the Hawarden Rural District Council, has had his salary increased by £30 a year.

Mr. E. W. Conchie, county sanitary inspector of Kincardine, has received permission to join the sanitary section of the R.A.M.C.

Mr. Alexander F. Mackenzie, architect, of Inverness was last week appointed burgh surveyor of Inverness, in succession to Mr. T. H. Scott, who has received an appointment at Port of Spain, Trinidad. Mr. Mackenzie was formerly a member of the town council, and has lately been engaged in the Land Valuation Department of Scotland.

Mr. A. S. E. Ackermann, B.Sc.(Eng.), Assoc.M. Inst.C.E., has been awarded a silver medal by the Royal Society of Arts for his paper on "The Utilisation of Solar Energy." This paper is entirely different from the one bearing the same title which he read before the Society of Engineers last year. In fact, it embodies both an introduction and supplement to that paper.

Tamworth Town Council on Wednesday considered in committee the appointment of a borough surveyor in the place of the late Mr. F. E. G. Bradshaw.

The following is a list of the members of the Leeds city engineer's staff who have enlisted for active service recently: L. Langstaff, clerk, Army Service Corps (Territorials); F. Lenton, clerk, Army Service Corps (Territorials); H. Morris, clerk, Army Service Corps (Territorials); G. W. H. I. Merry, architectural assistant, Leeds "Pals" Battalion; H. Stead, clerk, Royal Engineers; F. H. Foss, clerk, Royal Engineers.

The borough engineer's staff at Folkestone cannot be said to be lacking in doing its share in National service. In July, 1914, the staff consisted of the borough engineer (Mr. A. E. Nichols, M.Inst.C.E.), the deputy borough engineer (Mr. H. O. Jones, Assoc.M. Inst.C.E.I.), three assistants, a tracing clerk, and four clerks (all male). In July, 1915, it consists of the borough engineer (who is over military age, and is a special constable), the deputy borough engineer (who, being chief officer of the fire brigade, is at present "barred" by the War Office from enlistment, and is Commandant of a mobilised men's Red Cross detachment), one assistant and three clerks (two of whom are female and the other a boy). Two assistants (Messrs. H. F. Jackson and H. Dunglinson) and the tracing clerk (Mr. H. Whorwell) are in the Royal Naval Air Service, and two clerks (Messrs. C. A. Maycock and R. Millen) in the Motor Machine Gun Section, Royal Field Artillery.

OBITUARY.

Mr. Wm. C. Clifford Smith, M.Inst.C.E., Lic.R.I.B.A., engineer to the Asylums Committee of the London County Council, will have the sympathy of numerous friends in the loss of his younger son, Dudley Clarke, who died on Saturday last, at Wallington, Surrey, in his eighteenth year.

Electric Refuse Vehicles.—Chester Town Council on Wednesday decided upon the purchase of three electric wagons of 2 tons capacity for the removal of refuse, the cost to be met by four annual payments of £800 each. It was stated that the new mode of traction would result in a saving of £124 a year, as compared with the present system.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below:—Buildings: Aldershot; roads and materials: Carshalton, Godalming, Rowley Regis; sewerage and sewage disposal—Cleethorpes; water, gas and electricity—St. Pancras. Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Aberdeen C.C.—At a meeting of the Sanatorium Benefit Committee last week it was intimated that the Local Government Board had been reluctantly compelled to ask the county council not to proceed meantime with their scheme for the erection of their new sanatorium hospitals at Peterhead, Fraserburgh, and Ellon, in view of the order discouraging all fresh issues of capital. Until recently the committee had been urged by the Local Government Board to proceed with the provision of sanatoria, in which there was considered to be a serious deficiency. It was agreed to draw the attention of the board to their change of attitude.

Aldershot U.D.C.—The surveyor, Mr. F. C. Uren, has received instructions to prepare plans for the extension of the generating station.

Barrow-in-Furness T.C.—The erection of the additional cooling tower, for which a loan has been sanctioned, is recommended by the borough electrical engineer, also the provision of a fan and motor to increase the draught.

Enfield U.D.C.—The surveyor, Mr. R. Collins, has been instructed to prepare sketch plans and estimates for an underground convenience for both sexes at the junction of South-street and High-street, Ponders End.

Torrington R.D.C.—The council have accepted Mr. Featherstone's tender at £39 to build a bridge at Ladford Mill, between Shebbear and Newton St. Petrock. Other tenders were £43 and £59, while the estimate of the surveyor was £38.

West Sussex C.C.—It is proposed to erect, subject to the consent of the Local Government Board, revolving shelters for the treatment of tuberculosis, at a cost of £121.

PARKS AND OPEN SPACES.

Exeter T.C.—Further progress is to be made in laying out the Northernhay recreation grounds, at a cost of £100.

Manchester T.C.—A new open space is to be provided in the Barlow-road district of Levenshulme. Situate near Greenbank Farm, it comprises 24 acres, and is in the centre of a comparatively new and growing suburban area. Further new spaces are the Hulme Barracks site (comprising nearly 11 acres), and the Errwood-road Recreation Ground, Levenshulme, which covers an area of 54 acres. It will be one of the largest open spaces in the city when complete. On the Hulme Barracks site, which is in one of the most congested parts of Manchester, it is hoped to provide an open-air swimming bath.

REFUSE COLLECTION AND DISPOSAL.

Bridlington T.C.—The question of the disposal of the town's refuse came up on Wednesday in a letter of the clerk to the neighbouring rural district council, which threatened the issue of a writ against the corporation if the practice of depositing rubbish in the rural district was not stopped. It was decided to ask the rural district council to meet a committee of the council to discuss the question of the site of a refuse depot.

ROADS AND MATERIALS.

Athlone R.D.C.—In order to continue steam rolling in the district and schemes of direct labour on the main roads, it has been decided to issue a supplemental estimate. A motion to suspend operations until after the war was defeated.

Bampton U.D.C.—The surveyor, Mr. E. Rogers, submitted a report on the cost of steam rolling, giving the approximate cost of the work per yard and day work systems. The amount of steam rolling done by yard work, from February 3rd to June 30th, 1914, was 3,760 cub. yds., costing £235, or 1s. 3d. per cubic yard. This price included the supply of man and horse for water cart, hauling out chippings, and also a man for sweeping. Done by day work, from November 23, 1914, to June 9, 1915, 3,760 cub. yds., costing £203 2s. 6d. inclusive, or 1s. 1d. per cub. yd. This was a saving of £31 5s. on the amount rolled. Mr. Stone congratulated the surveyor in bringing forward these statistics.

Berkhamsted R.D.C.—The surveyor, Mr. H. N. Hedges, has received instructions to proceed with a scheme of footpath improvement.

Cardiff T.C.—With respect to St. Mary-street, about which complaint was made at the Public Works Committee, the city surveyor, Mr. W. Harpur, said he agreed that the street was in a bad state, but that there were places in the city ten times worse. But for the scarcity of material, due to the war, St. Mary-street would have been attended to long ago. The sub-committee was instructed to inspect the street in company with the city engineer, with a view of rendering it more suitable for traffic. Plenary powers were given the committee to purchase timber for relaying the street at the earliest possible moment.

Carshalton U.D.C.—The surveyor, Mr. W. W. Gale, has received instructions to prepare an estimate of cost for slab-paving a number of footpaths.

East Preston R.D.C.—The council have sanctioned an expenditure by the surveyor, Mr. C. W. Leney, of £110 for the provision of 360 timber breastworks with chalk filling for the improvement and defence of Rustington sea road.

East Sussex C.C.—Acting on a report of the Roads and Bridges Committee on improvements to roads, the council on Tuesday sanctioned a grant of £100 to Uckfield Rural District Council towards the cost of the improvement and repair of Walshes, Fermor, Hurtis Hill, and Sheep Plain-road, Crowborough. This road is being made up on the requisition of the War Office at a total cost of £3,291, of which amount the War Office are contributing £2,194 and the rural district council £1,097. The road is to be remetalled throughout for a distance of 3,300 yds., after first widening the culvert at the foot of Hurtis Hill, and the gradient of that hill eased to the extent of 2 ft. 6 in. by filling in with hardcore.

Galway R.D.C.—It has been agreed to contribute a sum of £150 towards the making of a new road leading from the Convent at Oughterard to Costello Bay. The Oughterard District Council have also agreed to raise a similar sum for the same purpose.

Godalming T.C.—An intimation has been received that the county council have agreed to a provisional estimate of £4,218 for the improvement of Bridge-road and Ockford-road.

Grimsby T.C.—It is proposed to make up certain passages under the Private Street Works Act.

Hackney B.C.—The Works Committee have recommended the purchase of two motor road-sweepers, at a cost not exceeding £1,276. The borough engineer (Mr. Norman Scorgie, M.INST.C.E.) estimates that the total cost of maintenance and working will be about £700 per annum. The cost of the work as at present done by horsed machines (including their maintenance and repair) exceeds £1,000 per annum.

Hayes U.D.C.—Negotiations have been completed with the Road Board for making up Yeading-lane, at an estimated cost of £1,050, of which sum £550 will be found by the council.

Hendon R.D.C.—Upon the advice of the surveyor, Mr. J. V. Webb, it has been decided to carry out tar spraying in Byron-road, Belmont-road, Stuart-road, and Locket-road.

Lutterworth R.D.C.—It has been decided to make up Gladstone-street, at an estimated cost of £250.

Notts C.C.—It was reported on Tuesday last that the work of the Road Board scheme is proceeding satisfactorily. Of the 21 miles of rural roads to be constructed this year nearly 10 miles had been completed. The actual cost of the construction of the Nottingham and Bawtry road has been £6,280, the grant from the Road Board being £3,110. The Highways Committee further reported that, owing to the

increasing difficulty of obtaining horses for haulage of material (which since the commencement of the war has in many districts become almost an impossibility) a large proportion of the work has had to be done by steam tractors. The cost of such haulage during the past fifteen months has worked out at an average price of 10¼d. to 10¾d. per ton per mile. As this appears to be excessive, the committee are of opinion that it would be more economical if the county council purchased tractors. It has been ascertained that in other counties and districts where tractors are the property of the county or highway authority the average price per ton per mile does not exceed 5d., and in some instances it is under 4d. The committee recommended that one tractor be purchased by the council at a cost not exceeding £800, and this the council agreed to.

Rowley Regis U.D.C.—A road improvement scheme, estimated to cost £1,500, is under the consideration of the council.

Strood R.D.C.—The council have agreed to take into consideration a report prepared by the surveyor, Mr. L. Randerson, on the question of purchasing horses, carts and haulage plant, in lieu of the present system of carrying out such work by contract. The surveyor estimated that if the council decided to do its own haulage there would be a saving of about £270 a year, and more if they undertook also the opening of a gravel pit and the driving of a small crushing plant.

West Sussex C.C.—It is reported that of an estimated expenditure on roads of £25,000, only £8,523 has been spent.

SEWERAGE AND SEWAGE DISPOSAL.

Bradford T.C.—The Sewerage Committee considered recently a communication from the Local Government Board with regard to the continuance of the Esholt sewerage scheme during the war. It was resolved to recommend the city council to inform the Local Government Board that it was necessary for the work to proceed, and a deputation was appointed to wait upon the Treasury with regard to the necessary financial arrangements.

Bristol T.C.—The Sanitary Committee recommend the council to apply to the Local Government Board for sanction to a loan of £850 for sewer reconstruction at New Brislington.

Cleethorpes U.D.C.—It has been agreed to take up a loan of £5,000 from the Public Works Loan Board for the sewage disposal scheme.

Coventry T.C.—The Sewage Farm Committee report that, by reason of the increased value of cattle and fodder, the agricultural department had made last year a profit of £898, as against a loss in each of the previous three years.

Doncaster R.D.C.—A scheme has been adopted for the sewerage of the proposed new village of Armthorpe, subject to an agreement being reached with the landowners on the question of cost.

Malpas R.D.C.—A scheme of sewage disposal, estimated to cost £400, is under consideration.

Stockton T.C.—It has been decided to adopt the water-carriage system in respect of about 200 houses in the Portrack district.

WATER, GAS, AND ELECTRICITY.

Edinburgh T.C.—The Electric Lighting Committee have accepted the tender of Messrs. G. & R. Cousin, at £5,000, for the foundation work in connection with the new electric station at Portobello.

Lurgan U.D.C.—The council are asking the Treasury for permission to borrow £47,000 to complete the purchase of the Lurgan Gas Light and Chemical Company, Limited, for which an Act of Parliament was passed recently.

Malvern U.D.C.—On the gas undertaking, the year's trading showed a loss of £165, as compared with a profit of £1,619 in the previous year, and the loss on the water undertaking was £3,066, as compared with a loss of £1,807 in the preceding year. In both cases this was mainly due to a falling off in receipts. The electricity undertaking showed a profit of £824, as compared with a profit of £317 on the preceding year.

Oswestry R.D.C.—The clerk, Mr. C. H. Bull, reported that he had received a letter from the Local Government Board with respect to the application of the council for sanction of a loan of £350 for the extension of the water main to Hengoed, and he had replied that this extension was under consideration for some time previous to the application of the original loan of £900 for the Weston Rhyn and St. Martin's scheme, and that the extension was part of the original scheme—so much so that the council included it when advertising for tenders. The extension was for Upper Hengoed and The Wern, which were without a proper water supply. The council were expecting some thousands of troops in the district, and it was important that, in preparing a hospital for the possible outbreak of disease, there should be a proper water supply to the isolation hospital. In answer to a member, the clerk said his letter had been acknowledged but not replied to.

St. Pancras B.C.—The Electricity Committee have received authority to provide two new boilers, and to carry out the work of enlarging the boiler-house, at an estimated cost of £13,000.

Wanstead U.D.C.—Notice has been received by the council from two electric supply companies of their intention to apply for a Provisional Order to supply electricity in the district.

York T.C.—In giving their formal approval to the borrowing of £15,936 for electricity purposes by the Electricity Committee, the Local Government Board write that they have decided, "though not without much hesitation," to sanction loans in respect of the expenditure already incurred, or to which the town council are committed. "The board view with great dissatisfaction the action of the town council in incurring this expenditure in anticipation of sanction. They must again warn the town council to avoid this irregular procedure in future, as it will not be possible for the board to be satisfied with repeating their warning in any similar case in future."

MISCELLANEOUS.

Edinburgh T.C.—The Streets and Buildings Committee have agreed to grant an increase of wages of 2s. per week to all employees in the roads department and the burgh engineer's department who were paid less than 29s. per week, and of 1s. to those whose wages were above 29s. and under 39s.

Twickenham U.D.C.—The council are instituting proceedings against tradesmen who fail to provide receptacles for horse-manure heaps.

The Newest Road Material—"I have been told that tins of beef have been used for mending roads in Flanders," said Lord Oranmore and Browne on Monday in the House of Lords, in calling attention to waste in the Army. It would seem that the elevations of such roads would soon vary. As the tins got punctured each bit of road affected would certainly become "high."

FOR OTHER ADVERTISEMENTS
See End of Paper.

CITY OF BIRMINGHAM.
APPOINTMENT OF CHIEF STOREKEEPER.

The Public Works Committee are prepared to receive applications for the appointment of a thoroughly competent Chief Storekeeper in the City Surveyor's Department.

Salary commencing at £156 per annum.

Candidates must be fully qualified persons, who have had practical experience in the keeping of Stock Accounts, and the acceptance and distribution of Stores of a large town. They must also have a good knowledge of the qualities of the various materials used by a Public Works Department.

The candidate appointed will be required to devote the whole of his time to the service of the Corporation, and also to contribute to the Superannuation Scheme, for which purpose he must submit himself to the Corporation doctor for examination, the appointment being subject to the doctor's report being satisfactory.

Applications, in candidate's own handwriting, stating age, experience, past and present employment, accompanied by copies of not more than three recent testimonials, and endorsed "Chief Storekeeper," to be sent to the undersigned not later than Monday, 30th August, 1915.

Canvassing, either directly or indirectly, will be a disqualification.

HENRY E. STILGOE, M.INST.C.E.,
City Engineer and Surveyor.

Council House, Birmingham.
July 27, 1915. (2,656)

BATTERY VEHICLES AS AN ADJUNCT TO TRAMWAYS.*

By W. H. L. WATSON.

The writer's experience during the past three years with many types of battery vehicles has been so satisfactory that he feels justified in an endeavour to direct the attention of tramway authorities to the virtues of this method of propulsion.

In towns such as Morecambe, Lancashire, where the conduit system is barred owing to the possibility of interference with the service by incursion of the sea, not to mention the high cost of such an installation, and where the overhead system is regarded as a menace to the scenic surroundings, the battery tram will be of great service. Horse trams have operated successfully for many years. With the advance of time electric traction has been seriously discussed, with the result that a scheme for installing battery-driven trams was considered, whereby a capital expenditure of, approximately, £18,000 was involved for the installation of twelve 56-passenger, double-deck trams, and the necessary depot complete with charging equipment and the extension of mains. The running costs were guaranteed not to exceed 5½d. per car-mile, covering write-off of capital, labour, and all running charges. If this installation is made it will be the first of its kind in this country, but there are existing trams working on this principle in the United States. It is interesting to note that battery rail cars, capable of carrying forty passengers with a total weight of 15 tons, average a current consumption of 600 watt-hours per car-mile; maximum speed 30 miles per hour; miles per charge of battery 100.

The battery omnibus will probably prove to be the more popular method of building up routes, prior to the extension of a full tramway service, owing to its cheaper installation and greater mobility. These 'buses are already installed in Southend, South Shields, York, West Bromwich, and Loughborough. In the first three instances the results have been very gratifying, the vehicles not only having given a highly satisfactory service, but the low running costs expected having been proved conclusively. At Southend-on-Sea, where one battery-driven 'bus was installed to run on equal terms with a fleet of petrol and petrol-electric 'buses, a saving of 2d. per mile, plus ½d. profit to the electricity department, making a net saving of 2½d. per mile, has been shown in favour of the battery vehicle.

At South Shields I find that the current consumption per mile varies between 1·63 and 2·10 units, the variation being specially noticeable owing to the road surface conditions encountered and variable weather. The maintenance charges have proved very slight, and with such a low average weekly revenue as 5·92d. the service covers expenses.

At York Mr. Hame announces that the four Edison 'buses have run 13,600 miles with an overall energy consumption of 1·1 units per mile.

The installation of 'buses at West Bromwich and Loughborough has only recently been made, consequently running costs are not yet available. They will be of special interest, as they are to cover routes previously occupied by petrol-driven chassis.

The ideal method of employing these vehicles is to fix a terminus at which point the vehicle awaits passengers for a few minutes. Here current can be taken at a high rate of input. The time taken to replace sufficient current (at six times the normal rate) to cover 1 mile of even road surface is 1½ minutes. Therefore a stay of 4½ minutes will in many cases replace sufficient current to cover the major part of a journey. At Southend-on-Sea it is no infrequent occurrence for the battery 'bus to return to its garage at night with no more than 40 ampere-hours used out of a total capacity of 300 ampere-hours after a day's journey of 100 miles. Where "boosting" facilities cannot be arranged a larger size battery may be necessary, but a mileage per day of 45 to 50 miles could easily be accomplished, provided the district is not of an extremely hilly nature. Upon hills the vehicle proceeds at a reduced pace, and where considerable gradients are met this is sometimes reduced to little more than a crawl. It should be appreciated, however, that it is possible to run 'buses under these conditions at a running cost which will render light services profitable, or at least self-supporting, whereas either petrol or petrol-electric 'buses would prove uncommercial.

SPEED.

It must not be assumed that the battery vehicle is incapable of speed; speed can be accelerated provided the current supply is in proportion to the distance to be traversed. The "electric" has been developed to travel at a useful speed under the most economical conditions. It is a peculiarity of the vehicle that when under way it appears to be journeying at a much slower speed than the mileage really registered. Including stops, it has been found capable of averaging a speed of 7½ miles per hour. This compares very favourably with the London 'bus, whose average rate of travel is approximately 8 miles per hour. It seems unwise to develop a new route under speed conditions, which can only result in a short life owing to the high running costs. The service will be much better appreciated if it is run upon conditions which the route can afford, thereby ensuring permanency.

Where the district is so scattered that a vehicle becomes a matter of necessity to the manager when doing his round of inspection, an electric roadster or coupé seems an ideal car to suit his purpose.

But for the condition of the country during the past year a new vehicle would have been placed upon the market suited for the conveyance of members of the staff on their duties. This vehicle is designed on very light lines similar to the petrol-cycle cars, which have become so popular. It is believed that such a vehicle would find much favour as a means of conveying inspectors, also for the collection of coppers, distribution of tickets, &c. This vehicle it is hoped will not exceed a cost of £300. Upon a similar chassis will be mounted a trade body of the box variety. This has been specially designed for the use of tramway departments in connection with their parcel delivery service. Here, again, low price has been given the utmost consideration—initial cost will be approximately £270. So great will be the advantage of such a vehicle to parcel delivery services that it seems likely a number will be employed once the low running costs have been suitably demonstrated. Assuming that an average mileage of 30 miles per day is accomplished during 300 days per annum, and current can be obtained at 1d. per unit, including current, maintenance, tyres, insurance, depreciation (seven years), and interest at an average rate of 5 per cent, the total running costs will not exceed 2½d. per mile.

The tramway departments of Ilford, Derby, and Belfast employ battery-driven tower wagons, each of which amply satisfies their requirements. These vehicles have a speed of from 11 to 12 miles per hour, which is generally found sufficient for the traffic to be negotiated. When out of service the opportunity is seized to revive the battery. The mileage available per charge is from 40 to 45 miles, which has proved more than sufficient for a day's work.

The battery will provide current for operating electric drills, saws, and riveters for bonding, and any other small tools in which either power or heat is required. It will be easily realised what an immense advantage it is to the testing engineer to have a large capacity battery at 70 volts available at any section or feeder pillar for testing purposes during times when the network is dead.

For maintenance of the track and road repairs a vehicle of 2 or 3 tons carrying capacity would be of great general utility. For carrying materials, such as pillars, setts, and other weighty equipment required on permanent tracks or extensions, this vehicle will do all that is required, and by provision of an interchangeable tank body of 500 gallons capacity a further field of usefulness will be provided for watering at any time when current is not available. This same vehicle has been utilised for carrying cables and drawing them into the ducts. It may sometimes be found useful for removing cars from a section where a breakdown has occurred, thus releasing the vehicles to proceed on their journey.

* From paper presented at the Seventh Annual Congress of the Tramways and Light Railways Association.

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

Change of Address.—The British Reinforced Concrete Engineering Company, Limited, intimate that they have (since July 2nd) removed from their premises at 82 Victoria-street, Westminster, S.W., to 1 Dickinson-street, Manchester, where larger and more convenient offices have been secured in close touch with their works at Trafford Park, Manchester.

SANITATION AT COSELEY AND SEDGLEY.

STAFFS. C.C. AND THE FEES OF CONSULTANTS.

At the meeting of the Staffordshire County Council on Saturday (the *Birmingham Post* states) the Public Health Committee reported that, as the result of communications with the urban district councils of Coseley and Sedgley as to the fees to be charged by Messrs. Hughes and Taft for acting as consultants, which were considered too high, they had instructed the engineers employed to report without the assistance of the consultants on the question of the sewage disposal of those places.

Mr. L. Foster moved that the paragraph should be sent back to the committee. He said it was impossible to have the report made without the assistance of the consultants, as they had all the available information at their finger ends. It was impossible for the council or experts in Birmingham to obtain information of the mining operations in the two parishes without the assistance of the consultants.

Mr. W. E. Fithern seconded the amendment.

Mr. Horner said that in face of the resolution passed by the county council some months ago he thought it would be a breach of faith to adopt the committee's report, which practically deprived the local councils of the assistance of engineers who had local knowledge of the working of the mines, contrary to the promise made by the county council.

Lord Harrowby said that controversy as to the sanitation of the two towns had been going on some years. Experts were called in by the county council, and at the request of the local authorities it was agreed that those bodies should be represented by two local engineers. It was understood that the charges of the local consultants should be reasonable, but it was suddenly discovered that they sent in an estimate of fifty guineas each because the county council had to pay the bill. The committee did not consider it was in the interests of the county ratepayers that they should pay one-third of such charge. They had been told that the two gentlemen had charged only twenty-five guineas for an exhaustive report to the local councils.

The amendment was lost, and the report of the committee adopted.

BUILDING RESTRICTIONS.

THE POSITION OF CONTRACTORS.

In the House of Commons on Monday the Chancellor of the Exchequer was asked whether he was aware that the request of the Treasury to the London County Council that all large building operations under their control should be restricted or postponed during the present crisis was interpreted by the council as an invitation to throw the burden of such restriction exclusively upon their contractors, the effect of which would be to inflict loss on the contractors and financial embarrassment on many of the sub-contractors; and whether he intended that the request of the Treasury should be so interpreted.

Mr. McKenna said the answer to the first part of the question was in the negative. The intention of the Treasury was that such postponements in regard to works already under contract should be made by arrangement with the contractors.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

EASTERN SUB-DISTRICT (NORFOLK, SUFFOLK AND CAMBRIDGE).

Mr. Robert Croome, the engineer and surveyor to the Cromer Urban District Council, has arranged to have a sub-district meeting at Cromer on Saturday, August 14th.

12.30 p.m.—Meet at the council offices.

Business.

Discussion on the question "How to put more life into the Eastern Sub-District."

Discussion on a short paper on "Road Tarring."

John R. Mead,
Hon. Secretary.

Ipswich.

It is hoped to be able to arrange with Mr. W. Lionel Jenkins, the county surveyor for West Suffolk, to have a sub-district meeting at Bury St. Edmunds in the near future.

Water Supply at Oldham.—A new mechanical filtration plant, which has been erected at Castleshaw waterworks in connection with the Oldham waterworks scheme, was formally inaugurated recently by the Mayor. The plant has been erected at a cost of £20,000, to improve the general purity of the water, and in order to utilise considerable quantities of flood waters which have previously run to waste. It is estimated that an additional 90,000,000 gallons of water per year will become available for supply purposes under the scheme.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

INSPECTOR OF NUISANCES.—August 3rd.—Holsworthy Rural District Council. £90 per annum.—Mr. C. Kinsman, clerk, Holsworthy, Devon.

HIGHWAY SURVEYOR. — August 4th.—Eastbourne Rural District Council. £200 per annum.—Mr. T. E. Varley Kirtlan, clerk, 92 Terminus-road, Eastbourne.

ASSISTANT SANITARY INSPECTOR.—August 5th.—Corporation of Lowestoft. £90—£120 per annum.—Mr. R. B. Nicholson, town clerk, Town Hall.

INSPECTOR OF NUISANCES.—August 4th.—Beddington and Wallington Urban District Council. £140 per annum.—Mr. T. Booth, clerk, 37 Manor-road, Wallington.

ELECTRICAL ENGINEER.—September 1st.—Corporation of Sutton Coldfield. £250 a year.—Mr. R. A. R. Nadin, town clerk, Council House.

ASSISTANT.—Wakefield Town Council.—Waterworks Engineer, Town Hall, Wakefield.

CLERK.—Dorset County Council.—Mr. E. Archdall Ffooks, clerk, County Offices, Dorchester.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

GLASGOW.—August 2nd.—For additions to Allan Glen's school, for the School Board.—Mr. J. Clark, clerk, 129 Bath-street, Glasgow.

SHEFFIELD.—August 4th.—For the extension of the city hospital, for the City Hospitals Committee.—City Architect, Town Hall.

DARLINGTON.—August 4th.—For additions to the boiler-house at the electric power station, for the corporation.—Mr. G. Winter, borough surveyor.

HASTINGS.—August 5th.—For alterations and additions to buildings, for the corporation.—Mr. P. H. Palmer, borough engineer.

SEVENOAKS.—August 5th.—For the construction of a masonry bridge, for the Sevenoaks and Tonbridge Rural District Councils.—Mr. J. Randerson, surveyor, Leigh, Tonbridge, and Mr. F. Harris, Broadway, Southborough, Tunbridge Wells.

RAWTENSTALL.—August 5th.—For the erection of a workshop, for the corporation.—Mr. J. Johnson, borough surveyor.

KENT.—August 5th.—For repairs to schools, for the Education Committee.—Mr. W. H. Robinson, architect, Sessions House, Maidstone.

DUNDEE.—August 7th.—For the construction of the columns, beams and floors forming the reinforced-concrete framework of the superstructure of the city hall, for the corporation.—City Architect, City Hall.

WOKING.—August 9th.—For the construction of a bridge over the Basingstoke Canal, for the urban district council.—Mr. G. J. Wooldridge, engineer and surveyor.

MERTHYR.—August 9th.—For the erection of 160 workmen's dwellings, for the corporation.—Borough Architect, Town Hall.

DONCASTER.—August 9th.—For the erection of a public convenience, for the corporation.—Mr. F. O. Kirby, borough surveyor.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. AUGUST 6, 1915. No. 1,229.

Minutes of Proceedings.

Highways and Modern Traffic.

The papers by Messrs. Gettings and Brodie on the "Improvement and Maintenance of Highways to Meet Modern Traffic Conditions," which were read at the annual meeting of the Institution of Municipal Engineers, and are reproduced in this issue, dealt with the subject from the different standpoints of the county surveyor and the borough surveyor. While county and town roads have many points of resemblance, they have also many points of difference. The traffic on the main streets of our large towns generally differs in character and volume from that of our main county roads, though in the immediate neighbourhood of large towns there is not so great a difference, since so much traffic from the railways has been transferred to the road by the aid of heavy motor vehicles. Still, the county surveyor is not often called upon to use wood paving, stone setts, or asphalt on his main roads, whereas in all large towns, and many small towns, these materials are in general use. For this reason, Mr. Gettings, in his paper, confines his attention to the use of ordinary macadam and tar-macadam, with its variants in the form of tar-painting and pitch or tar grouting.

Before reconstructing a road he considers it is necessary that a census of the traffic it carries should be taken, as the road must be made strong enough to carry this traffic, and, what is equally important, the future traffic it may have to carry. In considering this future traffic, account has to be taken not only of the natural growth of the district and its industrial expansion, but also of the increased use which improved road surfaces and the more general use of motor vehicles is bringing about. In considering the strengthening of existing roads, or the construction of new roads, the main point is to obtain adequate foundations. In existing roads it is necessary to have trial holes made at frequent intervals, so that careful records may be made of the subsoil, the thickness and character of the road material, together with local particulars as to how the road can be drained, the best gradients that can be obtained, and the cost of local road materials. Like his neighbour, Mr. Jack, of Herefordshire, Mr. Gettings has to deal with roads the majority of which have no foundations and lie on a clay subsoil. Both have experienced the same trouble with lateral spreading of the roadway, and have found that trenching the sides of the road and strengthening with rubble or slag is the most effective method of preventing this lateral movement, though Mr. Gettings is of opinion that a kerb is advisable wherever the traffic justifies the expense. He has found that a bed of clinker ashes 3 in. to 4 in. thick on the bottom of the trench prevents the clay from squeezing through the foundation material, and forms an excellent dry bottom. He is of opinion that it is not always the hardest material that is most suitable for ballast for strengthening, providing the bottom is well drained and the surface is sealed with bituminous material. Mr. Gettings has found that a 5-in. slag foundation is generally sufficient, but many surveyors find that 8 in. to 12 in. of hand-packed rubble or slag is necessary as a foundation for their principal roads.

Some interesting figures and a diagram were given showing the greatly increased use which some roads have had to undergo with the introduction of the motor 'bus and the motor lorry. On a gravel or sandy subsoil with a reasonable suberust and surface material from 6 in. to 8 in. thick, a tar-painted road will stand light motor traffic up to 100 tons per yard width per day, but when the motor 'bus and motor lorry come along, it soon develops potholes and corrugations. Mr. Gettings finds slag has proved most satisfactory for tar-macadam, and, being near large ironworks, it is the least costly of the materials he has used. The method of construction he adopts is somewhat unusual, for, although he follows the usual method of laying the materials in two coats, he tries to do this by sealing the bottom coat with $\frac{3}{8}$-in. material, and rolling the top coat of 1-in. to $1\frac{1}{2}$-in. material into it, and then sprinkling the surface with $\frac{3}{8}$-in. material, which is rolled so as to fill the interstices, and dusted with fine material, the total thickness being $3\frac{1}{4}$ in. to $3\frac{3}{4}$ in. He considers this method preferable to using graded material, and that it has the advantage of allowing the top coat to be stripped off independently of the bottom coat when it is necessary to repair the road. Most surveyors find that grading the material in the road makes a more satisfactory and solid road, and though it is doubtful if the top section can be stripped off by this method, it can only be done at the risk of having a top coat which would move bodily on the bottom coat, and so become corrugated.

* * *

Town Roads.

Mr. Brodie's paper dealt with the improvement of urban and suburban roads. He considers that all roads must be properly drained, and have adequate foundations either of hand-pitched rubble or concrete. While all surveyors will agree as to the necessity of draining, many will consider that foundations of the costly character he specifies are for many town streets quite unnecessary, and in some cases undesirable. The work carried out at Hornsey and other places with tarred clinker foundations is found to be quite satisfactory. Less costly, it is claimed to have a resiliency which neither concrete nor hand-packed rubble possesses, and that the surface material is free from the waves or corrugations that so many bituminous road surfaces have when laid on a rigid concrete foundation. That adequate foundations are necessary everyone is agreed, but

the attempt to make particular methods apply universally is not likely to succeed. Hardcore, gravel, and broken stone or slag are frequently used with success for foundations, and the foundation of every road must be decided with a proper consideration of the subsoil, drainage, traffic, and local conditions. So in the same way the statement that "water-bound macadam under modern traffic conditions is unsatisfactory from any point of view" is far too sweeping to be accepted. In the matter of foothold for horses it probably has no equal, and though, as Mr. Brodie pointed out, it ceases to be ordinary macadam when tar-painted, it is frequently much firmer, and freer from the creeping and waving that so many tar-macadam or pitch-grouted roads undergo under the influence of a high temperature and heavy traffic.

The objection to local stone being used solely on account of its cheapness is sound enough in its way, but a cheap stone is amply good enough in many situations, and its use as a foundation surfaced with a better quality stone can certainly be recommended as a suitable material. The widths of roadway sufficient for country roads are usually quite insufficient for town roads, as the character of the traffic is generally altogether different. As Mr. Brodie pointed out, 18 ft. may be a sufficient width for many country roads, but it is generally altogether inadequate for most town roads, unless they partake of the garden city type. Business vehicles, slow and quick traffic, and the tramway call for much greater widths in our towns, and while the 21 ft. may be too great in some purely residential streets, it is quite certain that the 54 ft., which Mr. Brodie considers the width of the ideal road should be, may in some of the larger towns be exceeded with advantage. The gradient of the road has not quite the same importance since the introduction of the motor-car, but few surveyors would care to make a road steeper than 1 in 20 if the local conditions would permit this gradient being obtained. The gradient of the road is to a great extent dependent upon the character of the material used for surfacing the road. A wood-paved or bituminous road cannot be laid safely with a steeper gradient than 1 in 20, but an ordinary macadam road would not be slippery at an even worse gradient, though the tractive effort required on such a gradient would make it unsatisfactory for horses.

The importance of a staff of properly trained workmen and reliable foremen is recognised by all surveyors, though unfortunately not always by their councillors. Many councils act as if they think the cheapest and poorest labour is quite good enough for road making, and it is well to be reminded that experienced men are necessary if we want satisfactory work at a time when so many surveyors are working with depleted staffs and their best men are being replaced by men who in peace times would be classed as "unemployables." In addition to the scarcity of trained men there is a scarcity of material, brought about mainly by the plea for economy which everywhere meets our local authorities. Surveyors at the present time are, like the Israelites of old, "trying to make bricks without straw," and as the age of miracles is past, the present neglect is bound to be paid for in the near future.

* * *

Orientation of Roads and Buildings.

If it be allowed that the primary object of town planning is to secure the health of the population of the future, the importance of the scientific orientation of roads and buildings, upon which the access of direct sunlight depends, is at once manifest. This is the theme of a most instructive paper on the "Healthy City of the Future," by M. Rey, which appears in the current issue of the *Town Planning Review*. The influence of sunlight upon health is among the earliest truths impressed upon the student of hygiene, and it is nothing short of a mystery, therefore, that in the development of modern cities practically no consideration appears to have been given to this important matter. We are beginning to perceive, says M. Rey, on the evidence of the facts which we have accumulated, that the supreme remedy for rendering towns healthy, and especially for successfully combating tuberculosis, is the penetration of the rays of the sun into all the possible corners of the city. Hence, these health-giving forces of an irresistible power which every ray of the sun contains ought to be the starting-point of a real revolution in the methods of town planning.

A determination to act upon this principle would involve many fundamental changes in the art of building as practised at the present day. In the first place, the closed court must be abolished in favour of a court largely open to the air and light facing on public roads rationally orientated. Then again, the daily course of the sun must be the sole consideration in deciding upon the orientation of buildings and their height. This means that the latitude of a town is an essential element in the problem—a fact which is clearly brought out in the very valuable table prepared by M. Rey showing the duration of access of sunlight to buildings of various heights and orientation in some of the principal towns of Europe and America. The basis of the calculation is the amount of sunlight which reaches the lowest part of the building on the shortest day, and the conclusion reached stated in scientific terms is that the width of the roads is a function of the latitude of the place, of the height of the buildings constructed on its alignment, and of the angle which the road forms with the meridian. It follows that when by-laws authorise buildings of the same height on roads of identical width, irrespective of their orientation, all the laws of light are utterly disregarded, and there is absolutely no encouragement for architects, builders, or owners to pay proper attention to this important matter. M. Rey's researches lead to very far-reaching conclusions, but they are none the less worthy of discussion, and it is therefore to be hoped that the fear of upsetting preconceived opinions may not be allowed to prejudice in any way the careful consideration of his investigations.

* * *

Manchester Municipal School of Technology.

Although in the present state of public affairs it is hardly to be expected that the number of students able to devote their time to systematic courses of technical instruction will be as large as in former years, it is eminently desirable that the motto "Business as usual" should, as far as possible, be applied in the realm of technical education. One thing at least has become abundantly clear as the result of a year of war, and that is that any nation desiring to hold its own in the years to come must organise its system of scientific technical education so as to secure the greatest possible efficiency. We observe with satisfaction, therefore, from the syllabus that has courteously been sent to us, that the work of the Manchester Municipal School of Technology, which may fairly claim to be one of the premier institutions of its kind in this country, is to be carried on as far as possible during the coming session on the same scale as heretofore. It has been found necessary to announce, however, that the prospectus is issued subject to the proviso that the number of lectures in the several courses may be diminished owing to rearrangements rendered necessary by the war. We would direct the attention of our younger readers especially to the courses of instruction in municipal and sanitary

engineering. The first year's course is designed to lay a broad mathematical and scientific foundation, while the second and third year courses comprise complete technical instruction in the various subjects which fairly come within the scope of the municipal engineer's work. Students who, having passed the matriculation examination or its equivalent, satisfactorily complete a three years' university course in accordance with the ordinances and regulations become entitled to the degree of Bachelor of Technical Science (B.Sc. Tech.), while students who, instead of having passed the matriculation examination, have passed the entrance examination or its equivalent before entering upon their university course, become entitled, upon satisfactorily completing the course in accordance with the ordinances and regulations, to the certificate of the university. The degree of Bachelor of Technical Science or the certificate of the university carries with it the title of Associate of the School of Technology.

* * *

The Service of Closing Orders.

The interests of the owners of property are so vitally affected by the provisions of the Housing, Town Planning, &c., Act, 1909, relating to closing orders, that any departure by a local authority from the strict procedure laid down by the statute is liable to be seized upon as a pretext for suggesting either that a closing order is void or that it is not operative. A case of this kind was heard recently by Mr. Justice Neville on a motion for an injunction to restrain the Hampstead Borough Council from proceeding to enforce a closing order made by them. Sec. 17 (3) of the Act provides that *notice of a closing order* shall be forthwith served on every owner of the dwelling-house in respect of which it is made, and that any owner aggrieved by the order may appeal to the Local Government Board by giving notice of appeal to the board within fourteen days after *the order* is served upon him. It appears that the Hampstead Borough Council did not serve any notice of the closing order in question other than a copy of the order itself, which was served on certain unknown owners in the manner prescribed by the statute—namely, by leaving a copy on the premises. Now, the provision as to service in this way only applies in terms to notices, and it was further argued on behalf of the plaintiff that, even if service of the order itself were sufficient to comply with sec. 17 (3), the council were bound to make personal service on every owner. Mr. Justice Neville found no difficulty in holding that serving a copy of the closing order was equivalent to serving notice thereof, and that the borough council were entitled to serve it by leaving it on the premises if after diligent inquiry they were unable to find any owners who might be entitled to service. To have held otherwise would have rendered the Act nugatory in any case where there was a single owner who could not be found, for the Act provides that a closing order does not become operative until either the time within which an appeal can be made—which, it will be observed, runs from the date of the service of the order—has elapsed without an appeal being made, or the appeal, if any, has been determined or abandoned.

* * *

Housing in Berlin.

The failure of town planning to produce any substantial amelioration in the housing conditions of the working classes of Berlin has been complete, for after many years of its operation the value of land remains at from three to ten times the value of similar land in London, and in consequence nearly one-half of the population live in one-roomed dwellings in tall tenements crowded round one or more internal courts. Moreover, London has about 30 per cent fewer deaths of persons between the ages of fifteen and twenty-five years than has Berlin, and a death-rate from tuberculosis of about 50 per cent less. It is true that its wide streets give the town a look of great spaciousness, but this appearance is characteristically deceptive owing to the prevalence of the tall, deep tenement. A consideration of these facts naturally leads us to inquire whether the efforts which are being made to improve our own towns by means of the ideas embodied in the Act of 1909 are not foredoomed to failure. Happily, we can answer this question in the negative, owing to the absence from our constitution of some of the vices which are inherent in the municipal government of Berlin.

As Mr. Horsfall forcibly says in writing on this question in the current issue of the *Town Planning Review*, in Berlin all the things necessary to ensure that dwellings shall be cheap are studiously left undone, and other things which insure that land and dwellings shall be very dear are done. The election of the town council under what is known as the "three-class system" is alone responsible for much of the evil which is allowed to continue. Under this system the small number of citizens who pay one-third of the total amount of taxes levied in Berlin in the largest amounts elect one-third of the members of the town council; the citizens, also few in number, who pay one-third of the taxes in the next largest amounts elect another third of the members; and the rest of the citizens, who pay the last third of the taxes in smaller amounts, elect the remaining third of the members. The result is that at least half the seats on the council are reserved for house owners, who are directly interested in perpetuating the existing conditions, although they form only about 1 per cent of the total population of the city. But the whole responsibility does not rest upon the council, whose policy, as the law stands, could be overridden by the State. And Mr. Horsfall does not hesitate to condemn the Kaiser for what he describes as his "great refusal" in not acting in a matter of such vital importance for fear of offending the property-owning interest.

* * *

Forthcoming Meetings.

The programme of the provincial sessional meeting of the Royal Sanitary Institute which is to be held at Brighton on September 3rd and 4th is of exceptional interest, and ought to attract a large attendance of members and visitors. On the first day discussions will take place on "Indian Sanitation" and "Camp Sanitation," and among the speakers on the former subject will be Major S. P. James, M.D., who will deal with sanitary problems in hospitals for Indian troops in England. There are two such hospitals in Brighton, both of which will be visited during the afternoon. An opportunity will thus be afforded of supplementing the discussion by practical observation. On the second day a discussion on the "Final Report of the Royal Commission on Sewage Disposal" will be opened by Dr. Samuel Rideal and Mr. J. D. Watson, M.INST.C.E., the engineer to the Birmingham, Tame and Rea District Drainage Board, and this will be followed by visits to the Shoreham Camp and the Brighton Electricity Works. The importance of the subjects and the eminence of the speakers alike guarantee an interesting and profitable meeting.

On August 21st—instead of the 14th, as previously arranged—an Eastern sub-district meeting of the Institution of Municipal and County Engineers is to be held at Cromer. These sub-district meetings are of a more or less local character, a fact which gives them a peculiar value, as they enable the members living in a given locality to get into closer touch than is possible at meetings which appeal to a wider constituency. One of the subjects for discussion at Cromer is "Road Tarring," and it is hoped that the meeting will be well supported.

The Improvement and Maintenance of Highways in Connection with Modern Traffic Conditions.*

By C. F. GETTINGS, M.INST.C.E., County Surveyor, Worcestershire.

As the author understands that another paper on this subject is being submitted, he proposes to deal with the matter in a brief form, considering the subject principally in connection with county main roads.

It is assumed that the majority of county main roads, excepting those adjacent to London and some in Lancashire, were constructed with ordinary macadam water-bound until the advent of the Road Board, when funds were provided from the Exchequer towards the cost of improving the surfaces in order to contend with the altered conditions of traffic.

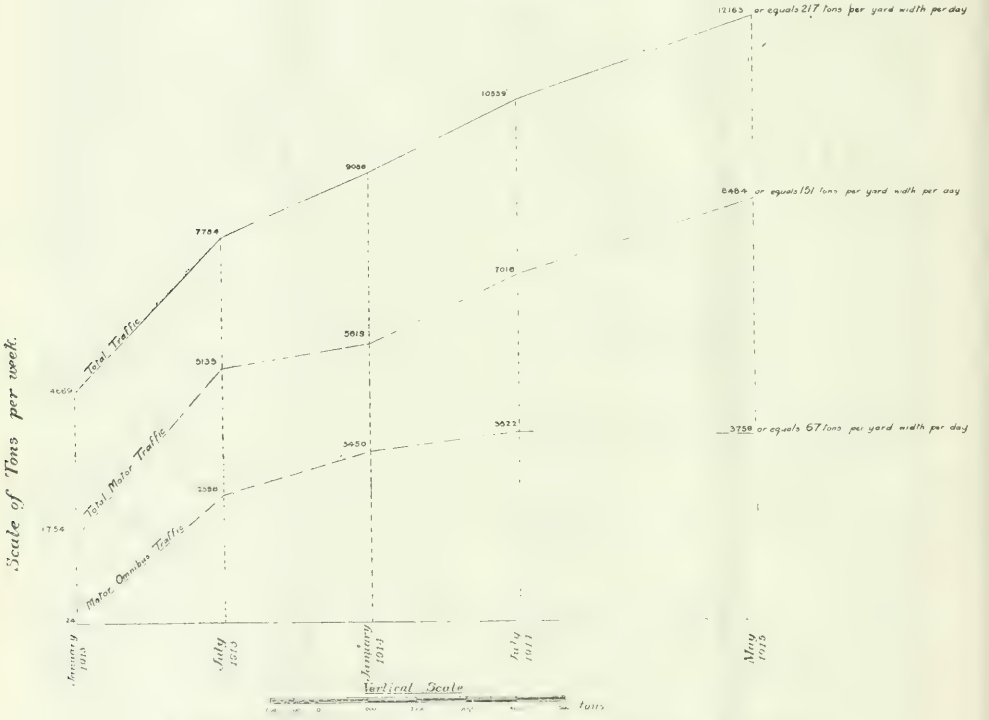
Before an ordinary macadam surface is converted into some other form of construction some reliable information should be obtained as regards the life and cost of maintenance, so that the figures can be compared with the estimated cost of construction and maintenance, together with the life of the new surface material. Unfortunately, the author has found it exceedingly difficult, in many cases, to produce reliable figures owing to the fact that the costs of repairs have not been properly allocated, the cause of this being due largely to the surveyor not being provided with an adequate staff. It is suggested that this leads to false economy, and if public authorities would recognise this many offices would be placed on a proper business basis. The author is a strong advocate of costs being carefully recorded, and, when possible, to have them shown in diagram form, so that a period of years may be seen at a glance.

The author did think of endeavouring to prepare a table showing when it is desirable to alter the type of surface material; but he has come to the conclusion that the information he has at disposal is not sufficiently reliable to enable him to prepare an accurate table, and probably estimates of the life of various surface materials would be misleading without knowing the conditions of traffic. He is, however, keeping a careful record of the work carried out in a scheme he has in hand, including actual initial cost and maintenance charges, and he hopes to be able to submit reliable data to his council at a later period. Progress records of work carried out are being made similar to Plate No. 4, so that each section of road can be readily referred to.

The type of construction to be adopted will vary in every county, also in various parts of a county according to local conditions and the class of traffic that has to be dealt with, and the author suggests that it is desirable to divide the roads into three classes, and fix up a standard for each class as regards surface material, according to traffic conditions, and to deal with the foundations and subcrust having regard to information that is obtained from actual trial holes and careful examination.

The first thing to do is to obtain a census of traffic in the form similar to that adopted by the Road Board, and after this has been calculated it should be plotted in a diagram similar to Plate No. 1. The author is of the opinion that it is important to divide the different classes of traffic in the manner shown, as this has an important bearing in assisting to decide upon the kind of surface material to adopt.

Trial holes should be made at frequent intervals on the existing roads, and careful records taken, giving particulars of subsoil, thickness, and class of existing material, together with any local information as regards subsoil and surface drainage, gradients,



Birmingham and Halesowen Road: Diagram showing Census of Traffic.

(Plate 1.)

Note.—The construction of this road is similar to typical cross section Plate No. 3. It was converted to Tarmac in July, 1914.

* Paper presented at the annual meeting of the Institution of Municipal and County Engineers.

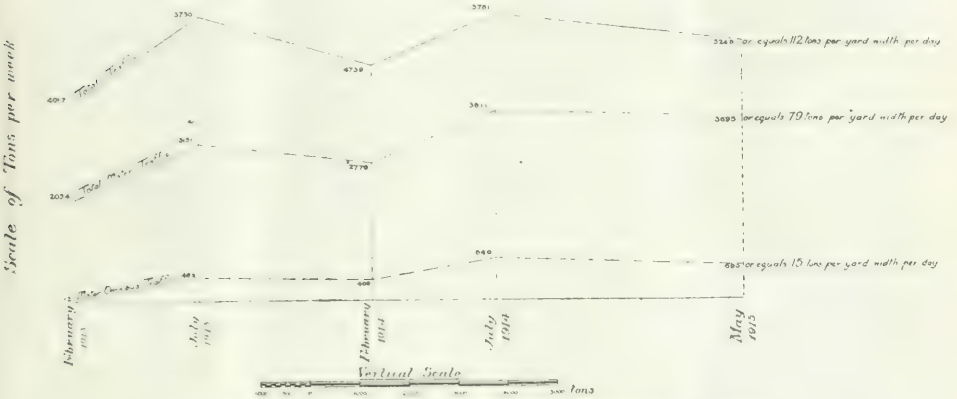
As [illegible] should also be read as to what local materials are available, together with prices delivered to road.

As several excellent papers have been published fairly recently giving descriptions of various surface materials that have been used during the last few years, the author does not propose to repeat them, as they are generally known to members of the institution; but he proposes to deal more particularly with some methods of construction which have been carried out under his supervision.

Unfortunately, the majority of roads in the county of Worcester lie on a clay subsoil, and have no foundation, so that it is necessary to provide subsoil or the opinion that it is not always the hardest material that is the most suitable, providing the bottom is well drained, and the surface is sealed with bituminous material.

Considerable care is taken with the laying of the foundation material to a proper contour, especially on all bends where the outer portion of curve is raised proportionately to the radius. Each foreman is supplied with a special-gauged straight-edge, with spirit-level, and the levels are carefully checked.

On a gravel or sandy subsoil, with a reasonable subcrust and surface material from 6 in. to 8 in. in thickness, the author has found that a road will stand light motor traffic up to 100 tons per yard width per

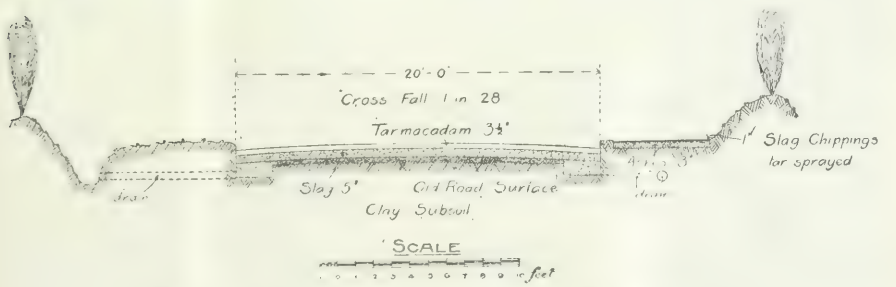


Worcester and Droitwich Road. Diagram showing Census of Traffic.

(Plate 2.)

and surface-water drainage and strengthen them before an improved surface can be laid. Plate No. 3 shows a typical cross-section of construction adopted in a scheme the author is now carrying out, and which is estimated to cost about £127,000. The minimum width of carriageway has been fixed at 18 ft., and the more important roads vary from 20 ft. to 24 ft. In the majority of cases this means widening the existing roads from 3 ft. to 5 ft. Generally there is a footpath on one side of the road, and this is being treated in the manner shown on section.

The author advocates trenching the sides, especially clay, provided it is tar-painted annually; but immediately a fast, heavy motor traffic, such as the motor 'bus or lorry, come along, the road soon develops pot-holes and corrugations. An instance of this is given on Plate No. 1, which shows an actual record of traffic on the Birmingham and Halesowen road, at Quinton. Up to three years ago this road consisted of about 6 in. to 8 in. of pebbles and granite surface on a dry marl bottom. In 1912 and 1913 the surface was tar-painted, and gave efficient results, but immediately the motor-'bus service began the surface broke up, and it was reconstructed last year in a method



Typical Cross-section of Reconstructed Road, Worcestershire.

(Plate 3.)

in clay subsoil, to prevent lateral spreading, and he has found the cost of this works out cheaper than a submerged kerb besides being more efficacious, although he believes in having a kerb to hold up the surface material if the traffic justifies the expense. He has also found that a bed of clinker ashes, 3 in. to 4 in. in thickness, on the bottom of the trench prevents the clay from squeezing through the foundation material, and forms an excellent dry bottom. Nearly 30 miles of roads have been dealt with during the past two and a-half years on this principle, and so far no trouble has been experienced. Fortunately excellent cold-blast furnace slag is obtainable within 30 miles distance, and this makes one of the finest ballast materials the author has had experience with.

As regards ballast for strengthening, the author is similar to Plate No. 3, excepting that the tar-macadam is 4 in. thick.

When a water-bound macadam road which has been tar-painted will not stand up to the traffic, one of the most common forms of conversion is tar-macadam, consisting either of slag, limestone or granite. Opinions differ as to the merits of the various materials, but generally with this class of construction the author ventures to suggest the results obtained from tarred slag have been the most successful and least costly. He has laid many miles of each kind of material, and frankly admits that slag has come out top, although he has obtained some excellent results in Devonshire with limestone, when there has been a moderate traffic.

Undoubtedly there have been many failures with

each class of material, and, unfortunately, the author has had one with limestone tar-macadam in Worcester. In this case the material was supplied ready mixed by a contractor, and it was proved that the fault lay in the stone not being properly dried, an inferior sample of tar being used, and indifferent mixing in a continuous mixer. The binding properties were taken out of the tar through it being overheated, with the result that, after it had been laid a comparatively short period, the surface disintegrated and would not stand up to the traffic. The author's experience with limestone tar-macadam is that it requires very close supervision. The stone should be thoroughly dried, but not overheated, and it is necessary to make careful experiments to find out the best mixture according to the class of stone to ensure uniform results.

The method of construction generally adopted by the author for laying tar-macadam is known as two-coat work, but he believes that he varies this rather from the usual form. The bottom coat consists of 2½-in. gauge material racked with 1-in. to 1½-in. material, this being lightly rolled with an 8-ton roller. A light layer of ⅜-in. gauge material is then spread on the surface immediately before applying a coat of 1 in. to 1½-in. material; these materials are consolidated together, and a sprinkling of ⅜-in. material, sufficient to fill in the interstices, is then applied and rolled. The surface is then dusted over with fine material, and the total thickness when finished is 3¼ in. to 3½ in.

The author prefers this method of construction to using graded material, as in his opinion a more uniform size of material is used with greater strength, in addition to which there is the advantage of being able to strip the top coat quite independent of the bottom when it is necessary to repair.

The system of what is known as pitch or tar grouting was brought into operation to a considerable extent some five or six years ago. There have been successes and failures, and on the whole the author ventures to suggest that the results have not been so uniform as those obtained with tar-macadam, which has been brought on to the site previously prepared and ready to lay. The author has laid some miles of pitch-grouted work, and although he believes his work compares favourably with that laid in other counties, he is not satisfied with the results. Clee Hill stone was used, and he had a complete portable plant, consisting of boilers, mixer driven by small engine, sand dryers, Wells surface dryers, &c. Medium pitch and creosote oil of a special quality were obtained, and careful analysis made before being used, so that a correct proportion of each material was used in the mixture. The stone was spread in the ordinary manner, and mixture applied by hand from ladles and cans. There are a number of difficulties in the grouting method which prevent uniform results:—

(1) The climatic conditions are an important factor, as unless it is dry it is impossible to do satisfactory work.

(2) It is difficult to get an even mixture.

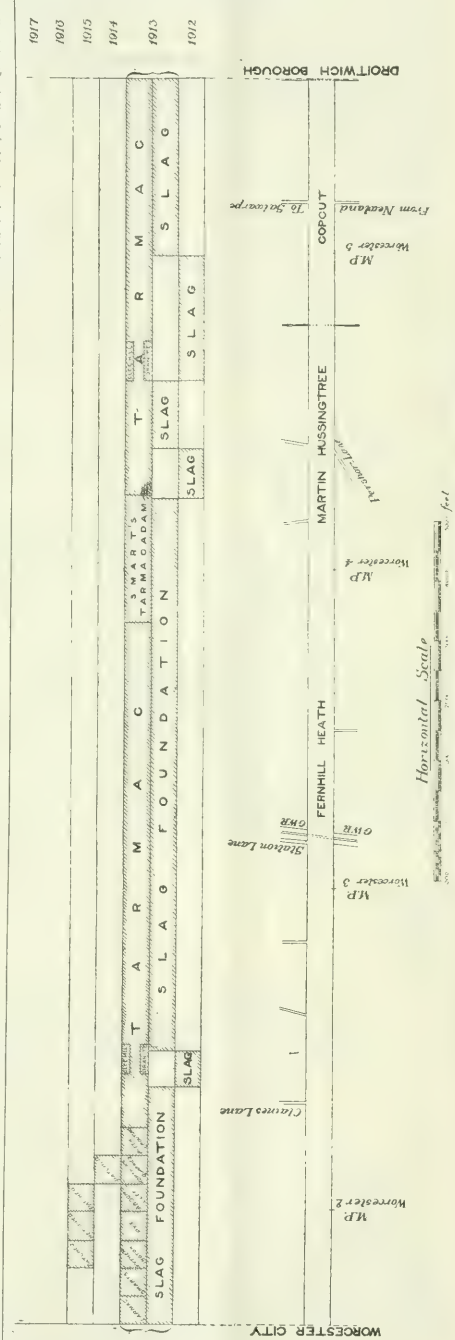
(3) It is almost impossible to get even distribution.

As a general rule the surface is more or less affected by high temperatures, and it has a tendency to become soft; the surface is also inclined to be slippery in winter.

The author has experimented with a surface sealing coat on tar-macadam consisting of a proportion of bitumen, but as the section has only been laid a few months he is not in a position to give any information, excepting that it is an extra cost above ordinary tar-macadam work. He is inclined to think that the principle is right where the traffic justifies the extra expense.

Worcestershire has not yet entertained asphalt construction in consequence of the initial cost, and not having suitable foundations on which to lay it; but the author thinks that there is a future for Trinidad Lake bitumen laid in a carpet method where foundations have been previously laid with a tar-macadam surface, especially where one has to contend with a fast, heavy motor traffic. The author has inspected the sections laid by the Limmer and Trinidad Lake asphalt companies for the Middlesex County Council on the Bath and Staines roads several times, and is of the opinion that they are excellent surfaces, especially the latter road. The only fault he has to find is that they are inclined to be slightly wavy, but at present he is unable to see that this is seriously detrimental; it is purely a matter of degree, and one that has not yet been overcome. It would be interesting and valuable information to have the particulars of traffic on these roads, together with the method of construction, &c., initial and maintenance costs.

Several sections of the non-bituminous type—such as Ferromac, Rocmac and Vianex—have been laid under the author's supervision, but these have been used principally on hills. Fairly good results have been obtained, but the author would certainly advise



Worcester and Droitwich Road: Diagram showing Record of Work Completed.

(Plate 4.)

that the surfaces should be treated with a bituminous sealing coat wherever the gradient permits. He has obtained the best results when the materials have been mixed in concrete form, and laid between the months of April and September.

It is not proposed to deal with wood or sett paving,

as, although this class of construction has to be dealt with in the north part of Worcestershire, owing to initial cost it is a form of construction generally laid in congested areas or under exceptionally heavy traffic conditions.

During the last few years some excellent portable mixers for bituminous material have been put on the market, and in a number of counties where they are not well situated for obtaining supplies they have proved to be economical. In the event of it being found desirable to manufacture your own material, the author favours establishing central depots, preferably adjacent to the quarries where the stone is obtained.

It is suggested that a material has not yet been invented in this country that is equally suitable for mechanical and horse traffic, especially for gradients. Many attempts have been made in this direction, but the author is of the opinion that there is not a bituminous material on the market on which, under certain conditions of weather, it is safe to put a draft [illegible] on a grade of less than 1 in 20. The nearest

from Government grants under a suggested system of classification, which has had to be abandoned for the time being.

TRIAL SECTIONS: WORCESTER—DROITWICH ROAD.

In connection with the Road Board reconstruction scheme the author is carrying out, it was arranged to lay down trial sections on the Worcester—Droitwich road, the surface materials consisting of those that could be reasonably entertained in the county having regard to their initial cost, and although these sections have not been laid two years until next August, the author thought the information that he has given to his council might be of interest to the members of the institution, and he submits it for what it is worth.

The site chosen is on the Worcester and Droitwich main road at Perdiswell, and the first length commences at the Worcester city boundary.

The road is very nearly level and straight, has an open situation, and is well drained, but is not kerbed on either side.

There are seven sections, each about 150 yds. in

WORCESTERSHIRE COUNTY COUNCIL ROAD BOARD SCHEME
TRIAL SECTIONS, WORCESTER–DROITWICH MAIN ROAD.

MAY, 1915. PLATE No. 5.

No. of section.	Name.	Date of completion	Weather during laying.	Area.	Cost of construction.	Cost per sq. yd.	Particulars and cost of repairs carried out.	Condition during winter.	Condition during summer.	Condition of surface May, 1915.	General remarks.
		1913		sq. yds.	£ s. d.	s. d.					
1	"Tarmac" tarred slag	Aug. 25	Fine	1,130	134 7 6	2 0½	Nil	Not unduly slippery	Satisfactory	Very good	This section is in excellent condition.
2	Smart's slag tar macadam	Sept. 4	Fine	1,0[illegible]	111 [illegible] 10	2 2	Nil	Not unduly slippery	Satisfactory	Very good	This section is in excellent condition.
3	Tytherington tarred limestone	Sept. 11	Showery	1,053	134 18 1	2 6	Patched May, 1915, £9 14s. 1d.	Not unduly slippery	Soft under the influence of the sun	Fair	This section is not altogether satisfactory, as it does not withstand changes of temperature.
4	Malvern Pyx stained stone	Sept. 17	Fine part of time, showery part of time	1,053	141 17 3	2 7	Arrangements have been made to re-top this section immediately	Surface broke up during wet weather, and was very muddy	Softens under the influence of the sun	Bad	This section is not satisfactory, as it does not withstand changes of temperature. The half width of road on west side is wavy, and there are many potholes.
5	Alsdon, Clee Hill tar-macadam	Sept. 24	Showery	1,100	148 1 10	2 6	Patched May, 1915, £8 10s. 8d.	Sealing coat liable to break up in small patches	Good, no softening	Fair	The surface was sealed with tar-painting, 1914, but this wore through in places during last winter, and potholes were formed down centre of road.
6	Northern Quarries tarred Leicestershire granite	Sept. 25	Showery	1,000	154 2 3	3 1	Patched by N.Q. Co., Nov., 1914. Must be re-topped this summer, 1915	Sound, but very uneven	Soft in hot weather	Very uneven	This section was one of the best until the warm weather affected it. During the summer, 1914, it was very soft. In addition to this, the surface was forced out of its original shape and is wavy.
7	Pitch-grouted Clee Hill granite by W.C.C.	Oct. 13	Very wet	1,087	141 1 7	2 7¼	6 sq. yds. replaced by tar-macadam, April, 1914, 19s. Small holes patched May, 1914, 9s. 1d.	Fairly good, but inclined to be slippery	Inclined to be rather soft during very hot weather	Good	The weather during the construction of this section was exceptionally unfavourable. The surface is slightly on the brittle side during frosty weather.

approach to this are mixtures which contain a large percentage of Trinidad Lake bitumen, but unfortunately the cost of this material prohibits its use excepting on heavily trafficked roads.

Opinions are frequently expressed that surveyors neglect to consider the horse when designing a modern road, and, although this is not true, it is fair to say that preference has now to be given to a form of construction that will stand heavy motor traffic. At the termination of the war it is practically certain that motor traffic will increase abnormally, and the author is of the opinion that the primary thing to do is to obtain a substantial foundation upon which it will be safe to lay an expensive surface material at a later date to withstand the traffic, as he believes that the time has arrived when all trunk roads have to be constructed to bear motor traffic carrying heavy loads, and travelling at a speed of 20 miles an hour.

Under the present system of taxation it is manifestly unfair to those counties where they have a considerable quantity of through traffic, but it is anticipated that some tangible assistance will be given

length, the total length being 1,096 yds. The road is 20 ft. wide, and the superficial area is 7,446 sq. yds.

Previous to reconstruction the road averaged 18 ft. in width, and the surface consisted of a very thin coat of Clee Hill granite, laid on a subcrust of gravel. The old road was left undisturbed, and the sides widened out to give the present width of 20 ft. A trench about 2 ft. wide and 9 in. deep was excavated on either side of the road, and filled in with 6-in. broken slag.

The sides were rolled, and then a strengthening coat of 3-in. to 5-in. slag was laid throughout and consolidated to a thickness of 5 in. by a 12-ton roller.

The various kinds of surfacing materials were laid to a depth of from 3 in. to 3½ in. when consolidated, and rolled by an 8-ton roller, except in the pitch-grouted section, on which a 12-ton roller was employed. Both the foundation and the surface coats were laid half the width of the roadway at a time, but only in short lengths, and the traffic was kept going without interruption during the progress of the work.

The whole of the work was carried out by the county council's own staff, and all the various kinds

of tar-macadam were laid by the same gang of men to ensure uniformity of work.

All the sections were tar-painted during June, 1914, and in nearly all cases the tar-painting had a beneficial effect, particularly in sealing the surface layer and in preventing this from breaking up.

The details of cost and report on condition are set out in Plate No. 5.

A record of the traffic on these sections is shown on Plate No. 2. It was originally intended to take a census of traffic twice a year, but unfortunately this was not done last winter owing to the war.

At the present time there is plenty of scope for experimental work in consequence of the rapidly changing conditions of traffic, and the author is of the opinion that every county should carry out a number of practical experiments, especially where suitable local material can be obtained, and these should be followed up with accurate laboratory analyses, so that an exact record can be compiled for comparison.

After a first-class road has been constructed it is necessary that it shall be properly maintained if economical results are to be obtained. This requires careful and constant supervision on the part of the surveyor's staff, and it is necessary to educate men to their work. Where small repairs are necessary the author has found that a self-contained light patching roller does much better work than the heavy machine, besides being much quicker. He has two of these machines, together with trailers, sleeping vans, &c., in his county, and they are giving excellent results.

Before concluding this paper the author would like to refer to the question of "contract" and "direct administration" systems, as he has had experience with both. In his opinion there is not the slightest doubt that the system of direct administration gives the greater satisfaction. With the contract system it is almost impossible to check the quantity of materials used or labour expended, and although contractors may be quite honest in their intentions there is invariably a tendency to take a risk that would not be done under direct administration. As a comparison the author would suggest any railway company contracting for the maintenance of their tracks, and as all companies maintain their own, it is evidently considered a sound policy from a commercial view.

The author suggests that the best results are obtained by dividing a county into districts, and having a competent assistant in charge working under the county surveyor from headquarters. If the work is centralised there will not be any overlapping, and it will be carried out economically with uniform results.

In order to obtain an efficient system, it is absolutely necessary for an authority to have a qualified and loyal staff who are adequately remunerated for their services.

Retford Corporation Fined for River Pollution.—At the Retford Borough Police-court recently, the Retford Corporation were defendants in an action brought by the Trent Fishery Board for pollution of the river Idle. The information was laid by the Fishery Board inspector, and stated that the corporation had permitted to flow into the Moorgate beck, which is a tributary of the Trent, gas tar and ammoniacal liquor to such an extent as to cause the waters to kill fish, contrary to the Salmon Fisheries Act, 1861. A fine of £5 was imposed, with £25 costs.

Belfast Water Supply.—It was reported recently to the Belfast City and District Water Commissioners that arrangements are being made by the engineer by which an additional quantity of some 12,500,000 gallons of water can be stored in Lough Shannagh, bringing the total available storage capacity of the lough up to 92,500,000 gallons, which will be available for use in the city during periods of dry weather. Since the very dry year of 1911 considerable additions have been made to the storage reservoirs, and this in each case has been done at a comparatively small outlay. The level of the Lough Mourne reservoir embankment was raised, by which the storage capacity was increased by some 127,000,000 gallons; Lough Shannagh, in the Mourne Mountains, was enlarged and made available for the storage of some 80,000,000 gallons of water; and the Middle South Woodburn reservoir is at present being enlarged to provide an additional storage of 90,000,000 gallons, and this work is now approaching completion. The total increase of storage since the year referred to will amount roughly to 310,000,000 gallons.

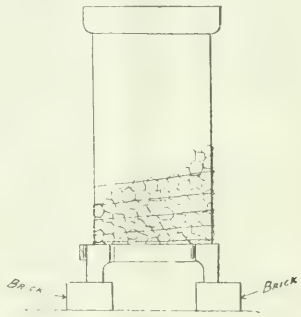
CORRESPONDENCE.

Εις ἀνηρ ὁυ πάντ' ορᾶ
(*One man does not see everything.*)
—Euripides.

CARDEN DESTRUCTOR.

To the Editor of The Surveyor.

Sir, — The accompanying sketch of a simple "destructor" suitable for burning garden rubbish may be of interest to some of your readers. It is suitable for burning such matters as weeds, garden rubbish, cabbage stalks, and the usual kitchen refuse. The destructor consists of a 12-in. diameter stoneware pipe, standing upon one of Stiff's aëration tiles, the feet of which may be set on bricks or a stone slab. It



Elevation.

Plan of aëration tile.

is advisable to encase the pipe in small mesh wire netting, keeping this in place by wire wound spirally as shown; cracks forming in the pipe are then of little moment.

The whole contrivance is compact and efficient. Obviously a larger pipe could be employed if desired with additional aëration tiles, or the units could be multiplied. A bundle of any dry combustible matter is thrown in first, and lit from under the aëration tile; when well alight, further rubbish is fed on, keeping the wettest material for the last. The ashes, in the form of white powder, fall through the slots to the ground, and can be raked away periodically with a bent iron. They contain potash, and form a valuable garden manure. It is quite possible in this way to return to the soil of a garden an appreciable proportion of the manure abstracted from it by plant life. —Yours, &c.,

G. Bertram Kershaw, M.Am.Soc.C.E.
9 Victoria-street, S.W.
July 29, 1915.

MRS. LILIAN BRADSHAW'S APPEAL.

To the Editor of The Surveyor.

Sir,—Is this not a case that ought to appeal to all surveyors, and prompt them to ask: "Supposing it were myself, what would the institutions I belong to do for my dependents"? Local authorities cannot consider them, with the result that when the breadwinner, whose salary was small, is taken away, all means of support may be gone.

Sir, your journal is read by many public authority officials, and I suggest that you open your pages for a subscription list with a popular figure as a maximum. The "dailies" start 1s. funds and raise good sums; why not say 2s. 6d. or 5s.? I feel sure it would meet with a ready response, as surveyors know that "many can help one," &c.—Yours, &c.,

P. G. P.

July 31, 1915.

[Mrs. Bradshaw's present circumstances are such that any monetary assistance would be most welcome, and we will gladly forward any remittances that may be sent to us on her behalf. At the same time it is to be hoped that a strong effort will be made to relieve her of anxiety as to the future of her child, by arranging that the boy is placed in a suitable home until such time, at any rate, as the mother is in a position to support him.—Ed. The Surveyor.]

BITUMASTIC ROAD CARPET FROM DESTRUCTOR CLINKER.

The Hornsey Town Council at their last meeting had before them a report of the Works and Estates Committee recommending the adoption of a scheme for erecting new buildings near the paving-slab machinery workshop at the sanitary depot, High-street, Hornsey, and installing new machinery for the manufacture of clinker bituminous road materials. As stated in our issue of June 18th, Mr. E. J. Lovegrove, M.INST.C.E., the borough engineer and surveyor, has succeeded in producing a bitumastic road carpet from prepared refuse destructor clinker which has all the properties that are conducive to long life—homogeneity, absence of brittleness, and resiliency. Considerable interest was aroused by our announcement with regard to Mr. Lovegrove's work, and the roads which up to the present have been surfaced with the new material have since been inspected by large numbers of road engineers.

It is estimated that the cost of the buildings which it is proposed to erect will be £2,200, and the machinery £3,600—a total of £5,800. The Road Board are willing to grant a free loan for the machinery for a period of five years; hence the annual expenditure in respect to initial outlay would be £720 for that period. Assuming a loan for the buildings is granted for the usual period of thirty years at 4¼ per cent interest, the annual expenditure on loan account would amount to £130 8s. 9d. per annum.

In a statement at the meeting referred to Mr. Lovegrove said: "The experience that the town council have already had of the wearing quality of clinker bituminous material laid in the borough, of which there is a total of 9,233 yds. (laid in 1914—April to August), places beyond question any doubt as to the policy of erecting permanent plant for carrying out the work. The asphalt laid in Park-road in August last used up the whole of the refuse from the destructor furnaces while the work was in progress, and provided on the old macadam road, at practically the cost of water-bound macadam, a smooth-running, durable surface capable of carrying motor-'bus traffic, and in one of the trial sections, in addition to motor 'buses, heavy steel-tyred vehicles from a railway sidings yard. During the present season (April to September) an area of 3,630 yds. has been laid in Ferme Park-road as general district work, and further areas of 3,000 and 3,400 yds. super. are to be laid, with the assent of the Road Board, in Endymion-road and Muswell Hill-road respectively as part of a scheme of surface reconstruction.

COST.

"It is generally recognised that the day of water-bound macadam is passing away, as even in the lesser trafficked roads the carriageways are subject in degree to the destructive effect of motor traffic. Hitherto the cheapest class of work in the recent types of bituminous construction has varied from an expenditure of 4s. to 8s. per yard super. on the prepared surface, varying from 1 in. to about 4 in. or 5 in. in thickness. The surfacing in Park-road averages 1½ in. in thickness, and was laid on the prepared surface at a cost of 2s. 3d. per yard super. under conditions involving expensive procedure in respect of hire of manufacturing plant, labour and wheeling; so that under better working conditions this price would be reduced. In this instance, the old road having been destroyed by motor 'buses, the preparation of the carriageway, by filling the holes and low places with coarse clinker asphalt to receive the surface coat, cost 11½d. per yard super.

"The machinery as designed provides for the production of the various grades of material, including filler, which would enable roads to be treated in different manner according to the particular requirements in each case, as in some instances the surfacing in shallow depth is not so suitable as a re-made and grouted surface, or so suitable as a thicker coat of two-class work; but, in whatever form the clinker is used as an aggregate, there is such a large saving in the use of the prepared waste product as compared with the purchase of aggregates such as granite, sand and cement, as to ensure the carrying out of all classes of bituminous construction at an unprecedented low cost.

"The disposal of the waste clinker from the furnaces—notwithstanding its general use for concrete, tar-paving, and hardcore, &c.—is becoming increasingly difficult, and the time is not far distant when conditions will obtain in Hornsey which now prevail in various districts in Greater London, where upwards of 2s. per ton or load is paid for the removal of the waste. The manufacture of footway paving with hydraulically pressed clinker has proved a satisfactory means of disposal during the winter months, and the proposed scheme will provide during the summer months an additional output entirely preventing accumulation."

METHOD OF MANUFACTURE.

In a description of the machinery Mr. Lovegrove indicated the method of manufacturing this road material. From the clinker heap it passes through a breaker, and the broken material is then elevated and passed through pulverisers, of which two are provided. It is then raised by an elevator to a revolving screen, whence the fine material is conveyed to the storage bins, a magnetic separator intercepting waste metal. The material is passed into a dryer, and then elevated into the mixer, which is placed at a level which will enable the mixed material to be shot directly into the vans or carts for conveyance to the site of the work. An arrangement is also provided for fan-drawing from the pulverisers and the workrooms the finer particles of clinker, a large quantity of which would otherwise be lost in the atmosphere, thus securing a valuable material to be used as a filler. The whole of the moving plant, except electric fans, will be driven by a steam engine supplied with steam from the destructor boilers, and an arrangement is made by which the waste gases from the destructor flue will be utilised for drying and heating the materials, auxiliary means of heating being provided when required.

The Highways Committee reported that the Road Board had assented to the resurfacing of the carriageways of Endymion-road and Muswell Hill-road with clinker asphalt, and that this would result in a reduction of at least £850 in the expenditure. They viewed the proposed new buildings and machinery with entire approval, and endorsed the recommendation of the Works Committee that application should be made to the Local Government Board for their tentative approval of the scheme, with a view to expediting the work when they again sanctioned the taking up of loans for public works.

The recommendations were adopted without comment.

The War and Public Works.—Among the public works held up by the war is the construction of the new small lock at Molesey, the difficulty being brought about by the Local Government Board refusing to sanction a loan to the Metropolitan Water Board, who are interested parties. The Thames Conservators recently decided to carry out repairs at the spot, postponing the larger works until later. The construction of the new bridge at Streatley and Goring also remains in abeyance, as the Treasury decline to sanction the borrowing of money for the new work during the war.

Manchester City Surveyor's Staff.—Further discussion took place at Wednesday's meeting of Manchester City Council on the question of the reinstatement of two of the three members of the city surveyor's staff who were dismissed some time ago. At a meeting of the Town Hall Committee on July 21st it was resolved that the two men should be retained in the service of the corporation, but it was now moved that notice should be given to the two men to terminate their service with the corporation, the proposer suggesting that their reinstatement would seriously affect the discipline of the department. The motion was agreed to by a large majority.

Traction Engine Restrictions.—A meeting of threshing-machine owners was held at Spalding on Tuesday to protest against the proposals submitted to the Departmental Committee of the Local Government Board by the County Councils Association with reference to placing further restrictions on the owners of traction engines. A petition was adopted protesting in the strongest possible manner against some of the restrictions and increases in taxation proposed. While agreeing that it may be necessary in the public interest to make some alteration in the law relating to both heavy and light locomotives, the petition states that the proposals with regard to the prohibition of bands on front wheels and the doing away with diagonal cross-bars on hind wheels of traction engines are unreasonable, as they would do away with the hauling power of the engines. It also urges that no additional restrictions and no increases in taxation should be placed upon traction engines used solely for agricultural purposes.

The Improvement and Maintenance of Highways to Meet Modern Traffic Conditions.*

By JOHN S. BRODIE, M.INST.C.E., Borough Engineer, Blackpool.

The mileage of public highways in the United Kingdom is, approximately, as follows: -

England and Wales	...	151,472 miles.
Scotland	...	24,816 ..
Ireland	...	58,334 ..
Total		234,622 ..

At the low estimate of £1,000 per mile for an average width of 18 ft. of carriageway, and £500 per mile for bridges, cuttings, and embankments, our highways cannot have cost us less than £350,000,000 sterling.

Now, considering that by far the larger proportion of our highways were made about the beginning of the last century, when the traffic conditions for which the roads were made were totally different from what they are now, and also keeping in mind that the moderate traffic then using the highways practically disappeared for three-quarters of a century in consequence of railway competition, it is not to be wondered at that our highways have been much neglected, and a valuable national asset suffered to fall into a very bad state of repair.

Then came what we may call the "road revival" with the traction engine, the light road locomotive, the bicycle, and the light and heavy motor cars, with their steel tyres, solid rubber and pneumatic tyres, and loads of from 12 to 20 tons on two axles.

The result has been what might have been expected, and as if modern railway locomotives and trains had been suddenly run on the original rails laid down by George Stephenson on the old Stockton and Darlington Railway.

The problem which now faces those of us who are responsible for the state of our highways is indeed a formidable one. The president of this institution, in giving evidence before a commission on heavy motor traffic, stated as his considered opinion that a sum of £287,000,000 sterling would require to be spent on the roads of this country to enable them to meet successfully the new traffic conditions. The author considers this estimate from so eminent and experienced an authority to be well within the mark and perfectly reliable.

In this short paper the author proposes to discuss the subject of urban and sub-urban roads, leaving the question of county and rural roads in the able and experienced hands of his friend Mr. Gettings, the county surveyor of Worcester.

ROAD IMPROVEMENTS.

The improvements of existing highways may be conveniently considered under the following headings:

(*a*) Foundations and wearing surfaces.
(*b*) Widenings.
(*c*) Diversions.
(*d*) Gradients.
(*e*) Corners and road junctions.
(*f*) Cutting hedges and trees.

(*a*) *Foundations and Wearing Surfaces.*

It has frequently appeared, from discussions on this subject in the Press, and even at conferences of road engineers and road users, such as the last International Road Congress, that there were no settled questions in regard to road foundations and surfaces. The author considers that this view cannot be seriously maintained, but that, on the contrary, we have agreed on points like the following:—

(1) That all roads, whatever the amount of traffic may be upon them, must be properly drained, and must have adequate foundations, either of hand-pitched rubble or Portland cement concrete.

(2) That the strength of the foundation must be fixed in relation to the amount of traffic it is likely to carry.

(3) That wearing surfaces must bear a proper relation, not only to the amount, but also to the nature of the anticipated traffic.

(4) That water-bound macadam under modern traffic conditions is unsatisfactory from any point of view.

(5) That the use of any and every "local" stone for road making or mending solely on the score of cheapness of first cost is financially unsound, and that only suitable material for road making should be used.

(6) That to make or maintain a road above or below the requirements of its traffic conditions is equally unsound financially.

(*b*) *Road Widenings.*

It has recently been laid down by a high authority that, except in the immediate vicinity of towns, a metalled width of 18 ft. of carriageway is generally adequate for traffic purposes.

Now, in urban or sub-urban areas, an 18-ft. width of carriageway between kerbs is absolutely inadequate. The author's own practice is a minimum of 32 ft. 6 in. between kerbs for roads upon which there is any possibility of through traffic, and a minimum of 21 ft. for what may be considered merely as roads for access to residential property. The width of 32 ft. 6 in. allows for a possible double line of tramways to Board of Trade requirements, and also for width of heavy motor cars under Local Government Board regulations—two very important advantages.

Larger widths are, of course, necessary for greater volumes of traffic, the ideal width providing for (*a*) two standing vehicles, one on each side of the carriageway and immediately opposite each other, (*b*) two lines of slow traffic, and (*c*) two lines of fast traffic, or a total width between kerbs of 54 ft.

Road widening improvements in built-up areas must always be very costly. Some interesting figures have recently been collected by Mr. W. T. Lancashire, city engineer of Leeds, and published by him, in regard to eight of the largest English towns, exclusive of the Metropolis, who have collectively spent over £16,500,000 sterling on road widening, at an average cost of nearly 1s. in the £ on their rates.

The obvious moral is, therefore, that road widenings should be made (and made on a liberal scale) well in advance of building operations, when the cost will be quite insignificant and the future benefits very great.

(*c*) *Road Diversions.*

Road diversions are generally made (*a*) in order to shorten the road or (*b*) to avoid excessive gradients by making a detour. In both cases the diversions can often be shown to be justified on grounds of economy alone. In a proposed diversion of a main road partly within (but chiefly outside) the author's district, the length of the present road is 2 miles 80 lin. yds., while the length of the road when diverted in a nearly straight line will be 1 mile 5 fur. 113 yds. It will thus be shortened by 627 lin. yds., or less than 83 per cent of the present length. The gradients will be considerably improved in the new road, so that the annual saving in maintenance will be upwards of 17 per cent, which will be a very good return on the capital outlay for carrying out the scheme, and a permanent saving both as regards maintenance and use for all time.

On the other hand, the author has made diversions where the horizontal length has been increased, but the reduction of gradient has been so considerable that, both in regard to the user and also the cost of maintenance, the advantages of the diversion have been amply proved.

(*d*) *Easier Gradients.*

The author considers there will be general agreement as to the three classes of ruling gradients in urban roads—viz.:—

For fast traffic, not exceeding 1 in 50.
For mixed traffic, not exceeding 1 in 30.
For purely local traffic, not exceeding 1 in 20.

In hilly districts, however, it will often be impracticable to obtain gradients even distantly approaching those given above.

A few years ago Mr. Howard-Smith contributed a few interesting statistics as to road gradients in towns, and their paved surfaces, over which very heavy town

*Paper submitted at the annual meeting of the Institution of Municipal and County Engineers.

traffic passed. These gradients, in addition to their steepness, were of considerable length, as follows:—

Locality.		Gradients.	Lengths in lineal yards.
Newcastle-on-Tyne	Pilgrim-street ...	1 in 6	110
Newcastle-on-Tyne	Hanover street ...	1 in 7	200
Wrailsor	The main street and principal approach to the Castle	1 in 9	100
Halifax ...	Pye Nest ...	1 in 10	250
Halifax	Bolton Brow ...	1 in 13	330
Gateshead-on-Tyne	Church street	1 in 12	160

[illegible] at Corners, Crossings and Junctions.

At all corners or turnings the curves should not be less than 100 ft. radius, and the convex side of the road having solid fence walls or close hedges should be removed and replaced with open railing, so as to be as free as possible from obstructions to sight for at least 100 ft. forward.

Road junctions and cross-roads should be properly bell-mouthed, when both sides of the road will, of course, be convex, and the same remarks apply.

Super-elevation, while it may be successfully adopted in simple turnings, should not be used at all in junctions or cross-roads; but the cross-road or junction should "mitre" into the main road, so as to avoid all "bumping" of fast traffic in both of the roads crossing each other.

Secondary roads joining or crossing main roads should have warning or cautionary notices fixed to slow down, as fast traffic on main roads should always have precedence over traffic on secondary or district roads.

[illegible] Hedges and Trees.

However picturesque they may appear, nothing will cause more harm to carriageway surfaces than overgrown and overhanging hedges and trees, which, by excluding the sun and wind from the surface of the road, prevent its being kept clean and dry. Hedges should be kept down by trimming at the proper time of the year, so as not to exceed 4 ft. in height above the surface of the road, except at turnings, crossings and junctions, where, as already stated, they should be replaced by open fencing.

ROAD MAINTENANCE.

The author must reiterate what he has often said before—that the most important factor in successful road maintenance is a staff of properly trained workmen, and especially reliable foremen, and also that such well-trained foremen and workmen should be adequately remunerated, proportionate to the experience and skill required for the work entrusted to them. No other outlay in connection with road work will make such a handsome return as a sufficient and well-trained, well-organised and well-paid staff of workmen.

Then only materials of the best quality should be used, both in construction, repairs and renewals. A frequent cause of excessive costs in road renewals and repairs is due to the use of local material of low first cost, but which turns out to be terribly

COUNTY POLICE OF BRECKNOCK.

Comparison of Cost of Road Maintenance for the last Ten Years.

Year ending March 31st.	Lengths of roads.	Cost of Maintenance.	
		Total cost.	Cost per mile.
	Miles dec.	£	£ dec.
1906	89·00	6,630	74·84
1907	91·83	5,034	55·14
1908	93·33	6,832	73 2
1909	94·16	4,929	52·33
1910	96·25	4,415	45·87
1911	97·75	4,917	50·3
1912	10·1·00	5,597	55·7
1913	100·76	5,595	55·54
1914	102·76	4,786	46·5
1915	104·14	4,486	43·06

expensive in the long run. The temptation to use unsuitable material for road work because of its apparent "cheapness" should always be resisted.

It is also of supreme importance that any signs of weakness in any part of the road surface should be at once investigated, the cause of it clearly ascertained, the proper remedy applied, and repairs effected without delay.

It is further of importance, not merely for the sake of good sanitation, but primarily in the interests of the road itself, that all dirt and filth should be cleansed from the road before it has time to be trodden in by the traffic.

The author inserts herewith, in a tabulated form, the cost of maintenance of all the roads in the area for which he has been and is the responsible engineer.

It will be seen from this table that, although the mileage of the roads has increased during the last ten years by about 17 per cent, the annual cost of maintenance has decreased about 32 per cent, the cost per mile showing a decrease of about 42 per cent.

The author attributes this gratifying result entirely to the foresight of his authority, firstly, by insisting on all new roads being made on those principles which experience has shown to be the best; and, secondly, in providing funds for practically reconstructing all existing roads so as to make them sufficient to meet all reasonable modern traffic conditions.

MUNICIPAL ECONOMY.

LOCAL GOVERNMENT BOARD APPEAL TO LOCAL AUTHORITIES.

On Wednesday the President of the Local Government Board issued a circular in which he impresses upon all local authorities the urgent need for strict economy in every branch of expenditure. Mr. Long says:—

"Items of expenditure which would properly be regarded as necessities in ordinary times must now be carefully scrutinised with a view to ascertaining to what extent they can be avoided or postponed. The fact that reduction of expenditure may cause some inconvenience to the public can no longer be regarded as a reason for continuing that expenditure at its former level.

"Expenditure on such objects as parks, recreation grounds, libraries, street lighting and watering, and the running expenses of all institutions require careful investigation with a view to possible economies. In some cases considerable economies should be possible; but even small economies are valuable, particularly where they involve the freeing of labour for other more immediately important functions."

For similar reasons Mr. Long suggests that local authorities should, as far as possible, refrain from requiring the execution of work the cost of which has to be borne by private individuals, unless the work is urgently necessary for the removal of nuisances or for the protection of health. For example, the issue of notices for the making up of private streets ought, in Mr. Long's view, to be postponed for the present, unless the circumstances are very exceptional.

Water Filters for the Troops.—A meeting, arranged by the Munitions Department, was held recently at the works of Messrs. Tuke & Bell, Limited. Mr. Holmes, M.P. for Govan, attended with several local gentlemen, and all the firm's men from both works were assembled. Mr. Holmes congratulated the men upon the good work they had put in during the past eight months on the water filters which Messrs. Tuke & Bell have been making for the War Department, and encouraged them to put forward their best efforts, pointing out that the work done in the workshops was as important as that done in the trenches. At the close of the meeting a vote of thanks to Mr. Holmes was proposed by Mr. Tuke, and seconded by Mr. Bell.

Water Undertakings of England and Wales.—A Blue-book on the water undertakings of England and Wales has just been published. The return shows the powers, if any, under which, and the limits within which, the supply of water is authorised, the places actually supplied, the sources, nature, efficiency, quantity, and quality; also the area and population, and number of houses supplied. This return, which was ordered by the House of Commons to be printed on July 28, 1914, contains no fewer than 599 quarto pages, and is issued at a charge of 5s. 1d. In the preliminary memorandum, extending to forty-three pages, it is set forth that the return may be regarded as the first instalment of the detailed and comprehensive investigation of the whole subject of surface and underground water supplies which has been recommended by various Royal Commissions and Committees. The return includes every water undertaking in England and Wales, and is divided into sections—local authorities, joint authorities, companies with specific powers, and private proprietors.

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING IN LONDON—(7).

At the recent annual meeting of the Institution of Municipal and County Engineers two papers on the

IMPROVEMENT AND MAINTENANCE OF HIGHWAYS,

by Mr. C. F. Gettings, M.INST.C.E., county surveyor of Worcestershire, and Mr. J. S. Brodie, M.INST.C.E., borough engineer of Blackpool, respectively, were presented for discussion, and are reproduced elsewhere in the present issue.

Mr. J. W. Horton (Derbyshire) said one sympathised with the difficulties of the authors in bringing forward any really fresh topic in such matters. With regard to Mr. Gettings' experience where he spoke of trenching the sides, especially in clay subsoil, to prevent lateral spreading, most of them would agree that a clay subsoil was most difficult to deal with, and it was absolutely necessary to have strong abutments at the sides to maintain the road in a good condition. There was nothing novel in it, but it was satisfactory to know that it had been tried by a member and found successful. Mr. Gettings spoke of the difficulty of obtaining a good limestone tar-macadam road. Of course, that depended very largely upon the amount of traffic, but he agreed that, except for light traffic roads, limestone tar-macadam was not suitable. A far more satisfactory road was obtained from ironstone slag macadam. Of course, local circumstances might force them to use limestone, yet he could not advocate its use for any heavily trafficked roadway. As to tar or pitch grouting, that class of work was not nearly so satisfactory as tar-macadam. There were disadvantages attaching to tar or pitch grouting. The weather was one of the great factors they had to take into consideration. A few light showers might entirely stop their work, and they could not get the same even results as from tar-macadam. He had found that they could not get such an equal distribution of the material as was desirable. He entirely agreed with the remarks as to the slipperiness of grouted roads as compared with tar-macadam. He thought at first that tar-macadam was likely to be more slippery than grouted roads, but he had had more complaints of slipperiness on grouted roads, and he thought better results were obtained from tar-macadam. Asked at this point by the president (Mr. H. T. Wakelam) to state more definitely what he meant by tar-macadam, Mr. Horton said he had used both limestone and ironstone slag macadam. In limestone, apparently, the tar wore off quickly, and the road became more dusty than was the case with slag tar-macadam. He had made some experiments with granite tar-macadam, but had not found any of them satisfactory, but he had recently laid a length of granite treated with bitumen as well as tar, and that was giving more satisfactory results. He should not like to speak of it, however, until he had had a longer experience. Of the material he had used, slag macadam had given the most satisfactory results.

Mr. H. W. Bowen (West Sussex), referring to Mr. Gettings' statement that he preferred the two-coat method of construction to using graded material, said that was absolutely opposed to the results he had found. On a road where they had recently had heavy military motor lorry traffic he had laid a section by the specification Mr. Gettings recommended, and as a continuation of that road a similar length of graded stone. He found the 1-in. coating put on stone of 2¼-in. gauge had practically moved entirely and become a series of corrugations. Where the stone was graded and rolled it was practically intact after six months of very heavy traffic. He should like Mr. Gettings to give the length of time this two-coat road had been down and the kind of traffic it had to stand.

Mr. R. A. MacBrair (Lincoln) said he should like Mr. Brodie to explain the comparative list of cost of maintenance included in his paper. In that he spoke of the cost per mile having gone down from £74·83 to £43·06. Did he think he had got to the lowest figure? They had heard that the cost of the maintenance of roads had gone up, but here it was said to be going down. In the last sentence he attempted to explain the reason for the reduction. He gave there two reasons—the foresight of the authority in having all roads properly made on those principles which experience had shown to be the best, and the reconstruction of all existing roads so as to make them sufficient to meet reasonable modern traffic conditions. Did the reconstruction of those roads come out of the cost of £43 per mile? If Mr. Brodie reconstructed many roads out of that the maintenance must be almost nothing.

Mr. T. Caink (Worcester) said he should like to thank Mr. Gettings for his paper, and more particularly for the experimental work he had carried out. He had reason to thank him, for the information enabled him to make a comparison close to his city of various descriptions of tarred materials. He had had a preference for tarred granite. He had put down a good deal with fairly satisfactory results, but, having seen that and other materials laid down on the same road with the same traffic, he must say that the tarred slag was evidently superior to the tarred granite, and in front of any other material that was exhibited. It was a great advantage to have a series of experimental lengths under one's eye like that.

Mr. J. D. Harwood (Worcestershire) asked what capital expenditure was necessary to obtain the results Mr. Brodie had told them of; also of the capital expenditure, what proportion did the Road Board meet, and what was the annual cost of interest and provision for sinking fund?

Mr. A. J. Price (Lytham) said he wished to say a word in favour of tarred granite. The feeling of the meeting seemed to be that one could not make a good job with it. His experience had been that he had been able to get good work with it, and a gentleman present could bear that out. The fact of the matter was that they had got to have good tar in the first place, but they did not always get it. The trouble with granite was that if they heated the stone too much the tar suffered. Many roads had failed because the tar was of too pitchy a nature. He had not had a single failure with tarred granite. He was quite certain that granite could be used, and that they could make a satisfactory job. At Lytham last year he showed the members a road which had been down for twenty-four years, and it was a perfectly good road then. There was not much traffic on it, but it was a good surface. As to limestone, he preferred that for residential streets. It gave them a more "sympathetic" roadway, and for footpaths it was more pleasant to walk on than any other material. Of course, they could make a very good road with slag, but they had not got a reliable material in slag because of its varying quality. There were slags and slags; some were honeycombed. They had to take great care to get a good slag; otherwise they did not get a good road. On the Blackpool front, where Mr. Brodie had a very good road made with tarred limestone, the road was made out of capital expenditure, and had had hardly anything done to it for the last seven or eight years except a few patches. He agreed that the ordinary water-bound macadam road was going to be a thing of the past, and that the use of tar-macadam would reduce their road-making bills.

Mr. S. S. Platt (Rochdale) asked, with regard to Mr. Gettings' reference to coating Roemac with a bituminous material, what sort of coating it was, how it was applied, how often it had to be renewed, whether there had been any complaints of slipperiness, and whether it completely reduced the dust.

Mr. H. Glynne Warne (Kingswood) said the question of capital expenditure and the decrease of cost maintenance had occurred to him. He noticed there were 25 miles more of roads than in 1906, and he wondered whether those roads, being newer and serving a residential district, and the traffic lighter, had had any effect in reducing the average cost per mile.

Mr. H. T. Chapman (Kent) observed that Mr. Gettings had mentioned as an advantage of two-coat work that the surface could be stripped off, and the base coat utilised. Personally, he thought he would find some difficulty in doing that. On one section of the road at Sidcup he found it practically impossible. With reference to those sections, he should like to inform members who might think of inspecting them that, unless they had with them some later particulars than the interim report of the Road Board, they might be misled. Nine of the sections had been reconstructed, and if any gentlemen were interested, and wanted to visit the road, he would be pleased to give them particulars up to March 31st. They

The Surveyor
And Municipal and County Engineer.

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would have an opportunity of inspecting three grouted sections—two laid down since 1911 and one in the last twelve months. Referring to two-coat work, he asked whether members had tried local materials with a carpeting of tarmacadam. He had used Kent ragstone coated with tar slag macadam, and it had given good results at greatly reduced costs. At the present time, when they had difficulties in getting supplies of materials, it would be well to consider the possibility of using inferior materials treated with pitch and tar to stand the wear of the traffic. Mr. Gettings' diagram with regard to the variations of the traffic was very interesting, and might be adopted by many surveyors.

Mr. H. PERCY BOULNOIS (Westminster) said he desired to call attention to one or two remarks by Mr. Brodie to which he took some exception. Mr. Brodie said "that water-bound macadam, under modern traffic conditions, is unsatisfactory from any point of view." He did not want that meeting to go away with the idea that water-bound macadam was absolutely condemned. Well made, with a sealing surface of tar, it was quite satisfactory for some classes of traffic. For rural districts it was a cheap road, and could be made a good road. Then Mr. Brodie said "that the use of any and every local stone for road making or mending solely on the score of cheapness of first cost is financially unsound, and that only suitable material for road making should be used." There again they must be cautious. If they were not to use local material, no advance in scientific investigation would be made. It was by trial and error that they succeeded. He did not wish that meeting to go away with the idea that local flints and gravels and limestone could not be used. Mr. Brodie also fixed the gradients; self-propelled traffic was not affected by these. The motor made light of these, and he did not think they need attach the importance to gradients that they had done in the past. But he agreed with the remark that the most important factor in successful road maintenance was a staff of properly trained workmen, and especially reliable foremen. It was what he had said over and over again. To his mind it was one of the most important things in road making.

Mr. PLATT, referring to Mr. Chapman's remarks, asked if the meeting could be given the lengths of road that had been reconstructed.

Mr. J. MONCUR (Staffordshire), alluding to Mr. Gettings' observations as to strengthening the haunches of roads, said he should not like the idea to go forth that the simple operation he had carried out was sufficient to strengthen a weak road. Mr. Gettings had suggested hard-core slag in the strengthening of the haunches. He should prefer block slag, 8 in. or 9 in. deep, to a broken slag in the foundation. Mr. Boulnois had expressed the views he had held many a day that it was quite possible, and practicable, to maintain satisfactorily an ordinary macadam road to carry a very fair traffic. He agreed that if they could seal the surface it would carry almost any traffic within reason. He did not agree with Mr. Horton when he said that a Tarmac road was less slippery than a pitch-grouted road. His experience was the very opposite to that. He had had no experience of Tarmac until this year, but he had tried Tarvia with good results. He was glad to see that in laying down the test lengths Mr. Gettings had allowed the old surface to remain intact without disturbing it in any way. He had never in all his experience (and he had 600 miles of road under his control) seen the need of scarifying a road except in the case of margins, where they had two metals to deal with. He had always felt it better to keep sound what was there.

Mr. R. S. LINDLEY (Godstone) remarked that they lacked as yet the foundation on which to build their roads; they did not know what were the modern requirements. It seemed to him that before endeavouring to tackle this question of what was the best foundation, and the best material of which to construct their roads, they should know what were the right and just and fair demands that their roads should take in the way of traffic. Their road authorities met in conference, and drew up by-laws which had been circulated by their institution and others, and they felt it to be very important, with respect to the maximum weight to be put on the road, what width of tyre and what weight on the wheels would satisfy modern requirements.

Alderman BAINBRIDGE (Birkenhead) said it was just as important in road making to have good workmen that they could rely upon as it was to have good material. They could have good material and men who were not skilled, and they could get very bad results.

Mr. R. H. DORMAN (Armagh) said he must take exception to what Mr. Brodie had said as to hand-pitched foundations. He agreed that for heavy trafficked roads they could lay granite pitched foundations; there were still many thousands of miles where they could not do it owing to the softness of the subsoil. That was his experience in Ireland. He took the old road surface and built on the top of the old road surface, putting the limestone on the top and rolling it down, making a better foundation than a hand-pitched foundation. As to the statement that water-bound macadam was unsatisfactory from any point of view, he thought a water-bound macadam was the only thing they could use on three-fourths of the roads of the country for years to come. He had 1,700 miles of roads, and he never thought of being able to treat more than 300 miles with special processes. As to the use of local materials, in parts of his county he had any amount of soft limestone, and found it most unsuitable for water-bound macadam; but recently he had tried the limestone with tar and got excellent results; 2 in. of limestone with 7 gallons of tar to the ton, rolled down, made a closely-bound tar-macadam, and on that he put screened chippings, using 1 ton of chippings to 10 tons of coarsely broken stone, thus making an excellent road. Four years ago he laid a mile of whinstone, a mile of hard flagstone, and a mile of tarred limestone. The first to wear out was the whinstone, and he was replacing it with tarred limestone.

The PRESIDENT (Mr. H. T. Wakelam) called attention to a paragraph in Mr. Gettings' paper in which he said: "It would be interesting and valuable information to have the particulars of traffic on these roads, together with the method of construction, &c., initial and maintenance cost." The reference was to the Bath and Staines roads. The initial cost of those roads was 8s. per square yard, plus 2s. 3d. maintenance spread over ten years, which worked out at 1s. per yard per annum.

Mr. W. H. MAXWELL (Tunbridge Wells), in a written communication, said he took exception to the generalisations by Mr. Brodie in this paper to the effect "that water-bound macadam, under modern traffic conditions, is unsatisfactory from any point of view;" also "that the use of any and every 'local' stone for road making . . . is financially unsound . . ." These statements were too sweeping and general in character, and so defeated their own object. For example, from the important point of view of "foothold," an ordinary macadam road surface was probably, in all seasons of the year, the best that could be laid: also,

in roadways of light and medium traffic, in culs-de-sac and such like, an ordinary well-made granite macadam road surface made a serviceable and economical roadway, especially in cases where the surface could be subsequently tar-painted. Under light traffic such surfaces often lasted for several years with very little attention. Even on "main roads" in country districts he had frequently observed that an ordinary well-made granite macadam roadway, subsequently tar-painted, gave a more serviceable and more even-wearing surface than some of the bituminous methods. He had been particularly struck, during recent years, when motoring over many miles of different descriptions of rural main roads, with the unpleasantly "bumpy" and corrugated character of "pitch-grouted" and some classes of tar-macadam surfaces—so much so, that it had been a pleasure to ride over a stretch of ordinary well-made macadam roadway, where the need for "shock-absorbers" had been much less apparent. He did not, of course, wish, in any sense, to condemn wholesale all and every class of bituminous road surface, as he regarded the water-proofing of road crusts as a decidedly beneficial step in the right direction; but his object was simply to point out the danger of sweeping, general statements which might, to some, prove misleading. Similarly, with regard to road metalling, the use of any and every "local" stone was not necessarily unsound practice, but frequently the reverse. It did not, of course, follow that because a stone was obtained locally, or in the immediate neighbourhood of the roads to be repaired, that such material was bad. On the contrary, if a district or town happened to be situated in or near a locality where good-class metalling was cheaply obtainable it would obviously be absurd to advise a highway authority that the use of "any and every 'local' stone" was financially unsound! The physical and chemical geological character of the stone itself must be the deciding factor, together with its relative price, and not the mere fact that the material happened to be "local" stone. In reference to the cutting of trees adjoining highways, difficulties frequently arose in some districts in this connection owing to the fact that "trees planted for ornament or for shelter to any hop ground, house, building or courtyard" were specially exempted from the provisions of the tree-cutting clauses of the Highways Act of 1835.

Mr. Gettings said he was very much obliged to those present for the very kind way in which they had received his paper. He would have liked to have given a little more time to its preparation, but, like many of them, he was working with a depleted staff. Mr. Horton referred to the fact that there was no new matter in these papers. It was most difficult to put in new matter. There were several things, one of which he just briefly referred to—the fixing up of some data on known conditions. He discussed it some twelve months ago with Mr. Killick, of Hertfordshire, who told him that when he was at the Road Board Sir George Gibb asked him to get out a comparative statement for ten or twelve years, and they spent some little time together on it. He had tried to get Mr. Killick to work on that information, and he hoped a little later he would submit a very interesting paper to the institution. Mr. Bowen referred to two-coat work. The longest period he could refer to was a road that had been down three and a-half years laid on this principle. That road had been only tar-painted once. It was taking rather more than 1,000 tons of traffic per day. It was on the Birmingham—Worcester road, and the road was looking in first-class condition. It had not been patched or touched in any way. He had found that it was very much better than putting on the larger material first and then putting on ¾ in. on the top, because when it started to go they had to pull the whole lot up. The question of repairs had been referred to. He had had to deal with one or two sections by stripping the top. In some cases they had had no trouble; in other cases they had a little trouble. He thought it depended very much upon the time of the year the material was laid. If laid in the winter months, when the weather was cold, they had a larger percentage of tar and a richer material. It was a most difficult material to deal with. Mr. Platt referred to the painting of non-bituminous materials. He had had three of those materials down for some two and a-half years. He put one stretch down originally with the intention of doing no tar-painting. It was through an important village on a trunk road. He wanted to see what the results would be; but he had such serious complaints from property owners of the dust nuisance—they said the dust was worse than from an ordinary road—that he was compelled to tar the surface. He had had to treat it each year, and it was standing up very well indeed. He thought to keep any of these materials in good condition where there was any amount of traffic it was essential they should be treated every year. Mr. Boulnois had referred to water-bound roads. He thought many of them who had a large mileage of roads thoroughly agreed with him. In fact, he just briefly referred to it in his paper; much depended on the subsoil. If they had a good, dry subsoil the water-bound road, tar-painted, would stand a considerable amount of traffic. He had one road which was taking 100 tons per yard per day. It was on their Worcester—Bristol road, which took a good deal of traffic. Mr. Moncur referred to foundations. He was afraid Mr. Moncur had rather misunderstood him. He understood Mr. Moncur to say he was only trenching the sides. He was trenching the road with larger material, roughly broken by hand. It was in the trenches that they put the smaller material. Thus, the whole width of the road was strengthened—not only the sides.

Mr. Brodie said he could honestly bear testimony to the fact that he had got very good results from limestone tar-macadam. Under certain conditions of traffic it was a very good road surface indeed. He was very much entertained by Mr. MacBrair's remarks, but was afraid that the day when his (the speaker's) road maintenance would disappear altogether was a long way off. However, there were hopeful signs that the bottom had not yet been touched. The table in his paper had been submitted because at a recent meeting he made the remark that, while his mileage had increased, his total expenditure had decreased. That was received in the light of a joke, so he had thought it well to put in the actual facts. One gentleman raised the point as to what capital expenditure was involved in these roads. The only road on which they had any capital expenditure in Blackpool was the promenade carriageway. That carriageway was about 3 miles 1 fur. in length. There had been an expenditure on that of £9,000, and that was the only capital expenditure they had had on any of their roads. It was quite true if they had a large capital expenditure they had little maintenance. He attributed the decreasing cost of maintenance almost entirely to the fact that at Blackpool they first of all considered their foundation. It was no use putting on any sort of surfacing unless they had a foundation to put it on, and every year he put in his estimates a good round sum for renewing or strengthening any foundations where required. They saw the result of that policy in the table he had placed before them. If they had a good foundation the road stood a chance of doing its duty to the traffic which came upon it. As to capital expenditure, he should like to say that they at Blackpool had not been as fortunate as many of them. They had got no grant from the Road Board at all. Mr. Boulnois raised one or two kindly criticisms on his paper. Mr. Boulnois agreed, or rather claimed, that the water-bound macadamised road, if properly sealed with some bituminous substance, was a success; but he wanted him to stick to the water-bound road with no sealing. As to trial and error in some of these known and cheap local stones, his experience had been many trials and many errors, and his general advice was to keep clear of any stone because of its cheapness. If it was good, all right; but not otherwise. Let an authority put their money down like men, and then they would get some good results. He was glad to see Alderman Bainbridge taking part in their discussions once more. It was a pleasure to hear him, because they always got some good advice from him—advice which was always given in the most tactful manner. Alderman Bainbridge was always a tower of strength in himself, and he always spoke with a good deal of common sense. It was well that gentlemen like Alderman Bainbridge should come forward and support their poor, downtrodden surveyors. He was sorry to disagree with Mr. Dorman as to hand-pitched foundations, but he (the speaker) was confining his remarks to urban roads, and not touching rural roads. So he did not think Mr. Dorman and himself were absolutely at variance on that matter.

(To be continued.)

New Swimming Bath at Paisley.—A new swimming bath, erected as an extension to the corporation baths in Storie-street, Paisley, was formally opened by Provost Robertson recently. The new building, which is to cost over £9,000, was designed and carried out by Mr. Jas. Lee, master of works.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The premium for July is awarded to

Mr. J. G. WILKIN,
County Surveyor's Office,
Courthouse,
Downpatrick,

whose contributions have, in the opinion of the adjudicators, been the best received during the month.

QUESTIONS.

THIS WEEK answers are invited to the following questions:—

494. Strength of Pillar.—A solid, square pillar, 10 ft. in height, with a section 2 ft. by 2 ft., and weighing 50 cwt., is subjected to a horizontal wind pressure of 28 lb. per square foot on one side. Assuming its material to be uniformly elastic, find the intensity of compressive stress at the leeward edge and at the windward edge of its base.

495. Radius of Gyration.—Explain from first principles the precise meaning and significance of the term "radius of gyration" as used in the investigation of the theory of beams.

496. Stand for Procession.—A stand with seats is required, from which to view a procession, upon a site 40 ft. by 10 ft. The front is to be 4 ft. above pavement behind some iron railings. Give section and part plan to a ¼-in. scale.

497. Gauging Sewers.—Describe a suitable method for gauging the flow of sewers.

498. Buttress Design.—Thirty feet (30 ft.) above the ground a rectangular buttress bears a thrust of 5,000 lb. inclined at an angle of 45 deg. If the buttress is to be 3 ft. wide, and is built of masonry 140 lb. per cubic foot, find its thickness. Also find the height of a turret 3 ft. by 3ft. necessary for stability at the top joint if the coefficient of friction = 0·60. (E. P. C., *Town's Album.*)

499. Geodesy.—Describe generally (without details) the astronomical observations needed to locate the starting-point of a survey in a new country. (E. P. C., *Town's Album.*)

500. Sewage Tank.—A sewer discharging into a sea outfall is connected to a storage tank l feet in length, b feet in breadth, and h feet in height. The tank discharges directly into the sea by means of an orifice a square foot in area, connected to low-water level by a short pipe of the same area, the top of the tank being at high-water level. Neglecting losses due to friction, and assuming that no sewage is admitted to the tank during the period of emptying, that the tide has a range of r feet, and that the tide curve is harmonic, find approximately the time taken to empty the tank. (Stud.Inst.C.E.)

REPLIES TO QUESTIONS.

493. Theory of Beams.—A girder is continuous over two spans of 20 ft. and 15 ft. respectively. What are the relative reactions of the three supports? (Inquirer.)

Consider a beam continuous over a series of supports, then for any two adjacent spans the following expression applies:—

$$M_1 l_{12} + 2M_2 (l_1 + l_{23}) + M_3 l_{23} = -6\frac{A_{12} x_1}{l_{12}} - 6\frac{A_{23} x_2}{l_{23}} + 6EI\left(\frac{d_1 - d_2}{l_{12}} + \frac{d_2 - d_3}{l_{23}}\right) \quad . \quad . \quad (1)$$

Where, referring to Fig. 1.—

M_1 = bending moment in beam at support No. 1
M_2 = " " " " " 2
M_3 = " " " " " 3
l_{12} = distance between supports No. 1 and No. 2, centre to centre
l_{23} = distance between supports No. 2 and No. 3, centre to centre
A_{12} = area of the bending moment diagram for span 1 2, drawn on the assumption the beam is not continuous, but consists of a number of separate beams, or in other words, that the beam is cut through over each support
A_{23} = ditto for span 2 3
x_1 = distance of the centre of gravity of the area A_{12} from support No. 1
x_2 = distance of the centre of gravity of the area A_{23} from support No. 3
d_1 = distance of support No. 1 below some selected datum
d_2 = distance of support No. 2 below some selected datum
d_3 = distance of support No. 3 below some selected datum
E = modulus of elasticity of the material
I = moment of inertia of the section of the beam

As the above is true for any two adjacent spans of a continuous beam, then, if there are "n" spans, we shall have ($n-1$) equations. There are ($n+1$) unknowns (*i.e.*, the B. M. at each support of the "n" spans), so that we require to know the end conditions of the beam to have ($n+1$) equations to find ($n+1$) unknowns.

If the supports are all on the same level, then $d_1 - d_2 = 0$, and $d_2 - d_3 = 0$, and again, if we assume the beam to be under a uniform blanket load then $x_1 = \frac{l_{12}}{2}$ and $x_2 = \frac{l_{23}}{2}$, so that our general expression becomes

$$M_1 l_{12} + 2M_2 (l_{12} + l_{23}) + M_3 l_{23} = -6\frac{A_{12} l_{12}}{2l_{12}} - 6\frac{A_{23} l_{23}}{2l_{23}}$$
$$= -3 (A_{12} + A_{23}).$$

The bending moment diagrams for the spans 1 2 and 2 3 will be parabolas whose maximum ordinates are each $\frac{wl^2}{8}$ (l = span), so that we have—

$$A_{12} = \tfrac{2}{3} \text{ base-height} = \tfrac{2}{3} l_{12} \frac{w l_{12}^2}{8} = \tfrac{1}{12} w l_{12}^3$$

and,

$$A_{23} = \text{" } \tfrac{2}{3} l_{23} \frac{w l_{23}^2}{8} = \tfrac{1}{12} w l_{23}^3$$

As we are dealing with a beam which is continuous over only two supports, then M_1 and M_3 are each equal to zero, so that the general expression further reduces to—

$$2M_2 (l_{12} + l_{23}) = -\tfrac{1}{4} w (l_{12}^3 + l_{23}^3)$$

or,

$$M_2 = -\tfrac{1}{8} w \frac{l_{12}^3 + l_{23}^3}{l_{12} + l_{23}}$$

In question, $l_{12} = 20$ feet and $l_{23} = 15$ feet, and by substituting these values in the above we get—

$$M_2 = -\tfrac{1}{8} w \frac{20^3 + 15^3}{20 + 15} w$$
$$= -40{\cdot}6\, w$$

Let Fig. No. 2 represent the beam in question under a uniform load w per foot run.

A D B and B F C are the parabolic bending moment diagrams, B E is drawn to scale to represent M_2 and is $= 40{\cdot}6\, w$; it should be noted that this moment produces flexure in an opposite direction to that as represented by the parabolas; attention therefore must be paid to the sign of the moments when they are superimposed as in Fig. No. 2.

The parabolas ADB and BFC represent moments which produce curvature thus $\smile$; whilst the triangle AEC represents moments which bend the beam $\frown$. The nett bending moments are therefore represented by the shaded area, and the points X and Y are points of inflexion where no bending moment exists. If the bending moment diagrams be drawn carefully to scale the reactions at the supports can quickly be determined; for by projecting the points X and Y to P and Q we divide the continuous beam into A P and Q C, which may be regarded as two beams with free ends

resting on the cantilever PQ at P and Q respectively. We can write therefore—

Reaction at support No. 3 $= \frac{1}{2} ws_3$

" " No. 1 $= \frac{1}{2} ws_1$

" " No. 2 $= \frac{1}{2} ws_1 + \frac{1}{2} ws_3 + ws_2$

or, the reaction at the middle support may be obtained by subtracting the sum of the reactions of the end supports from the total load.

The reaction at the middle support can be obtained directly from the value of "M_2" by the formula—

$$R_2 = R_2^1 + \frac{M_1 - M_1}{l_{12}} + \frac{M_2 - M_3}{l_{23}}$$

Fig. 1.

Where R_2 = reaction for continuous beam at middle support

" R_2^1 = reaction at mid-support when it is assumed that the continuous beam is cut through at the supports and becomes a series of separate beams.

Then

$R_2^1 = 10\,w + 7{\cdot}5\,w$, where w is the uniform load per foot run

$= 17{\cdot}5\,w$

But $M_1 = 0$ and $M_3 = 0$

so that

$$R_2 = 17{\cdot}5\,w + \frac{40{\cdot}6\,w}{20} + \frac{40{\cdot}6\,w}{15}$$

$= 22{\cdot}23\,w$

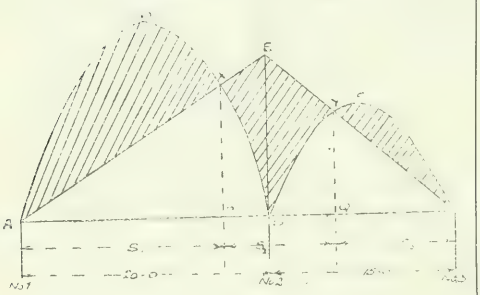


Fig. 2.

Similarly

$$R_1 = R_1^1 + \frac{M_1 - M_0}{l_{10}} + \frac{M_1 - M_2}{l_{12}}$$

(where M_0 is the bending moment at an imaginary support to the left of support No. 1)

$$10\,w + 0 + \frac{-40{\cdot}6}{20}\,w$$

$= 7{\cdot}97\,w$

and

$$R_3 = 7{\cdot}5\,w + \frac{-40{\cdot}6}{15}\,w + 0$$

$4{\cdot}8\,w$

so that

$R_1 : R_2 : R_3 = 7{\cdot}97 : 22{\cdot}23 : 4{\cdot}8$

or

$R_2 : R_1 : R_3 = 1 : 1{\cdot}465 : 4{\cdot}63.$

(M. T. R., *Rhyl.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Lowestoft T.C. (July 29th. Mr. H. Shelford Bidwell).—£7,500 for sea defence works on the North and South beaches. It was stated that the object of the application was to reinstate that portion of the work which was in urgent need of repair. It was with some reluctance that the council had decided to make the application, and but for the war a much larger sum would have been applied for. The original work was carried out in 1902-4, at a cost of about £43,000. The attention of the council was drawn to the condition of the work last autumn, and as a result of a survey made by the borough engineer a scheme was submitted, involving an expenditure of £12,767. The matter was discussed by the council, and referred back to the Sea Defence for revision, without exposing the works to undue risks. The result was that the scheme was cut down to £7,500. This was the amount which the committee felt could be spent with any degree of safety. The borough surveyor, Mr. G. H. Hamby, explained the position of the groynes on the North Beach, and the work proposed to be carried out. The inspector said the groynes appeared to have served the town very well. The borough surveyor also described the work on the South Beach, and the inspector expressed his satisfaction with the plans. The inspector intimated that he would make a personal inspection of both beaches.

FORTHCOMING INQUIRIES.

AUGUST.	£
10.—**Sheffield.** For fire station extension (Mr. F. H. Tulloch)	4,067
11.—**Godalming.** For sinking boreholes and laying water main (Mr. A. W. Brightmore)	1,750
12.—**Godstone.** For works of sewerage (Mr. A. W. Brightmore)	1,200
17.—**Lutterworth.** For the purchase of a waterworks undertaking (Mr. A. W. Brightmore)	3,400

APPLICATIONS FOR LOANS.

Cardiganshire C.C.—£1,200 for a school at Aberporth.

Chester T.C.—£500 for the purchase of property for street improvement.

Hitchin R.D.C.—£100 for the provision of cottages.

Plymouth T.C.—£17,089 in respect of the taxed costs of the Plymouth Corporation Bill.

Watford U.D.C.—£1,560 for electricity mains.

LOANS SANCTIONED.

Doncaster T.C.—£2,275 for light railway undertaking.

Repton R.D.C.—£1,637 for sewerage and sewage disposal works.

Shropshire C.C.—£5,269 for buildings, water supply, and roads in connection with small holdings.

Staffs C.C.—£3,125, part of the cost of the erection of Stafford engineering school.

Woolwich B.C.—£2,172 for electricity mains and house-wiring.

Chester Electricity Works Profit.—The statement of accounts for the year ended March 25th last shows that the gross profit of the year's working of the Chester Corporation electricity works was £12,483, and after meeting interest and sinking fund charges a nett profit of £3,194. A sum of £6,933 had been contributed out of revenue to the capital expenditure, a sum of £1,118 had been contributed to the lamp rate, and the balance was carried forward as a working balance. The report of the auditor stated that, after debiting interest and sinking fund charges on loans and the revenue contributions to capital expenditure, the surplus for the year was £2,973.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings, Retford; housing and town planning, Enfield; roads and materials, Lancashire; sewerage and sewage disposal, Colnbrook, Newry, Rugby; water, gas and electricity, Coventry. Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

ADMINISTRATION.

East Sussex C.C.—With reference to the appointment of a district surveyor for the West District, the Roads and Bridges Committee proposed that the West District Committee be authorised to appoint a district surveyor at a salary and an allowance not exceeding the present amounts, and in the event of this being carried the committee be authorised to advertise for candidates for the post. After some discussion, in which it was suggested that it would not be advisable to advertise as they might get applications from men eligible for military service, an amendment was carried that the matter be left in the hands of the committee to get the work of the district surveyor carried on for the present.

BUILDINGS.

Bedwellty U.D.C.—The surveyor, Mr. H. D. Price, has received instructions to prepare plans for an underground convenience.

Croydon T.C.—Repairs and repainting are to be carried out at the waterworks, at an estimated cost of £115.

Ealing T.C.—It is proposed to enlarge the isolation hospital, at an estimated cost of £910.

East Sussex C.C.—The county surveyor, Mr. J. F. Wood, recently informed the council that, owing to the increase in the prices of materials and the difficulties in obtaining tenders, and looking to the fact that a large quantity of timber and other materials used in reconstruction of Rye Bridge which could be used for the work had been obtained when prices were lower than at the present time, some expense would be saved by carrying out the works of rebuilding Boreham Bridge by direct administration. It was agreed to rescind the resolutions of the council accordingly, and the county surveyor was authorised to carry out the works of rebuilding, and engage a clerk of the works at a salary not exceeding £4 per week, the total cost not to exceed £650, the amount already voted by the county council. The county surveyor was also authorised to carry out repairs to the bridge over the Medway at Forest Row, and the bridge over the adjoining stream, at an estimated cost of £650.

Hebburn U.D.C.—The deputy surveyor has been asked to prepare a modified scheme of alterations to the laundry at the hospital.

Honiton R.D.C.—The tender of Messrs. Fothergill Brothers, at £108, has been accepted for the new footbridge at Land Park, Sidmouth.

Lindsey C.C.—It is proposed to provide a school clinic at Barton-on-Humber at a cost of £100.

Middlesex C.C.—Owing to the war the proposal to erect a new lunatic asylum at Heston, at a cost approaching £500,000 sterling, has been dropped.

Retford T.C.—In connection with the proposed provision of a new isolation hospital, the committee have made arrangements to visit the Lodgemoor Hospital, Sheffield.

Warrington T.C.—It is proposed to build a small-pox hospital, at an estimated cost of £1,500.

HOUSING AND TOWN PLANNING.

Briton Ferry U.D.C.—The Housing Committee last week reported upon the successful completion of the workmen's dwellings scheme, which had involved an expenditure of £16,000. In congratulating the surveyor (Mr. H. Alex. Clarke) the chairman said that, notwithstanding the abnormal conditions, the original estimate had only been exceeded by £14.

Coventry T.C.—Mr. Poole last week submitted the annual report of the Housing Committee dealing with the administration of corporation work in regard to artizans' dwellings. There was a loss, he said, of £125, but that loss was more apparent than real, and was partly owing to the builders' strike of a year ago. On the general position, the speaker mentioned that the corporation were housing 220 families, and that schemes for 182 more houses were in hand; but the committee had applications for between 1,400 and 1,500 more houses, the applications coming from doctors (for patients), employers (for employes), and from working-class associations.

Enfield U.D.C.—The surveyor, Mr. R. Collins, has been instructed to prepare a town planning scheme, including in the area that portion of the district between the New River and the Cheshunt branch of the Great Eastern Railway, from the north side of Hoe-lane to the Cheshunt boundary.

West Bromwich T.C.—The question of the Mayer's Green housing and improvement scheme was before the council last week. On account of the demolition of houses in carrying out what is recognised as a great public improvement, the council must, under the provisions of the Housing of the Working Classes Act, 1903, undertake a housing scheme. The Sanitary Committee reported that the Local Government Board required the erection of twenty houses on a site or sites to be approved by them, and according to plans also to be approved by them. The scheme has to be carried out out within twelve months from its approval by the board, but in view of the restrictions which the latter are placing on loans by local authorities it was very doubtful whether the board would require the scheme to be executed within that period. The committee recommended that the scheme be carried out, stating that particulars as to site, kind of house, and rental would be submitted later. The report was adopted.

PARKS AND OPEN SPACES.

Llandudno U.D.C.—The new nine-hole golf course laid out by the council at Maesdu was opened on Monday last. The completion of the full course of eighteen holes has been postponed owing to the war. The course has been laid out from the plans made by Mr. H. S. Colt, golf architect, of Sunningdale. The distances of the holes are as follows: First, 310 yds.; second, 500 yds.; third, 280 yds.; fourth, 350 yds.; fifth, 400 yds.; sixth, 340 yds.; seventh, 270 yds.; eighth, 180 yds.; ninth, 420 yds.; the course thus comprises a total distance of 3,050 yds. A pavilion belonging to the council, and conveniently situated a little distance from the Maesdu-road, has been handed over to the Maesdu Golf Club for use as a club-house. The council have handed over the management entirely to the committee of the club, who have already enrolled some 150 members.

REFUSE COLLECTION AND DISPOSAL.

Swansea T.C.—The council have adopted a report by the Health Committee recommending the provision by householders of sanitary ashbins, and bins in the streets for the deposit of waste paper.

ROADS AND MATERIALS.

Barnstaple R.D.C.—A sub-committee recommend that the highway district be divided into two, Mr. A. A. Richards being in charge of No. 2, at £210 a year, and a second surveyor to be appointed for No. 1 at £140. At the same time the committee suggested that, in view of the difficulty of getting suitable men owing to the war, the matter be adjourned, Mr. Richards to continue as at present, with extra assistance for special work when required. The report will be forwarded to the county council.

Brigg U.D.C.—It has been agreed to execute temporary repairs to the road at North Killingholme, and the surveyor, Mr. E. K. Clark, has been instructed to prepare plans and specifications for a new road. The estimated cost is £750.

Cheltenham T.C.—Calling attention to the efforts of the Lighting Committee in economising the expenditure on gas lighting in the side streets, the Mayor expressed approval, but pointed out that there was room for similar economy in the principal thoroughfares, where electric lamps were installed. It was true the brilliancy of the arc lamps was now dimmed by the shades put over the globes, but the cost of the light was the same, and what he was afraid of was

that when, after the war, the shades were removed, the contrast between the lighting in the chief avenues and that in the side streets would be so great that there would be an immediate outcry for the restoration of the lamps now removed from the latter thoroughfares. Mr. Rees Jones replied that within the last two or three years the cost of the electric lighting had been reduced by £2,500, whereas the gas company had recently added or were about to add £600 to the gas bill by raising the price of gas 8d. per 1,000 ft.

Congleton T.C.—The borough surveyor, Mr. J. H. Walters, has received instructions to prepare estimates for making up Twemlow-street and Princess-street.

Cork R.D.C.—The council recently passed proposals for schemes of road improvement and road rolling estimated to cost £2,850 in the aggregate. It was stated that the works would be half county and half district charges, the expenditure to be repaid in five years.

Glasgow T.C.—The city council last week approved of the proposed improvement of Cathedral-square. The scheme will make available for the carriageway and footpath about 200 sq. yds. fronting Castle-street.

Halifax T.C.—Private improvement works are to be carried out in Rosebery-avenue, Siddal, at a cost of £429.

Keighley T.C.—The council as a committee have decided to view the Westgate slum area with a view to an improvement scheme. Two schemes have been proposed informally, one estimated to cost £134,000, and the other £94,000.

Lancs C.C.—The Main Roads and Bridges Committee estimate that the cost of tar-spraying main roads during the current year will be £17,615, and the cost of resurfacing the main roads with tar-macadam £34,861. The Road Board have intimated that they will make grants towards the cost. The committee have a balance of £1,000 out of the vote of £6,500 for the erection of a tar-macadam plant at Carnforth, and they recommend that an honorarium of £200 be paid to the county surveyor, Mr. W. H. Schofield, as an appreciation of the inception of the scheme and of the manner in which the works have been designed and carried out.

Lindsey C.C.—The Highways Committee reported that they had received and considered communications from district councils in response to the county council's representation that economy should be exercised in the maintenance and improvement of roads at the present time. All the replies were entirely in sympathy with the views of the county council, and the county surveyor reported that there would be a saving on the amounts originally approved by the Highways Committee of a sum of about £9,409. The council agreed that urban and rural district councils be paid the balances of the total payments made by the county council in respect of the maintenance and repair of main roads during the year ended March 31, 1916—urban districts, £1,255; rural districts, £5,359.

Manchester T.C.—With regard to the proposed purchase of certain property in Cross-street for the purposes of improvement, the Local Government Board have written that they "do not consider that the present is an opportune time for entering into commitments of this character," and that they would not be prepared to give any approval or sanction in the matter.

Oakham R.D.C.—A letter has been received from the clerk to the Rutland County Council, stating he was directed by the Main Roads Committee to recommend that the centre portion of the main roads only should be tar-painted, leaving sufficient space on the sides for horse and cart traffic. The surveyor, Mr. W. S. Woodcock, said that was the principle he had been acting upon on the main roads, but there were some parts of them where they were not more than 16 ft. wide, and there was not room to tar-paint the centre and leave a track on each side. It was only in isolated instances where he had tarred the whole of the roadway.

Pontefract T.C.—The Gas Committee's accounts for the year ended March 31st, presented at Wednesday's meeting, showed a profit of £535 10s. 5d. The committee recommended that the price of gas be increased from 2s. 11d. to 3s. 3d. per 1,000 cub. ft., the chairman, Mr. C. Pease, stating that this was calculated on the cost of coal being increased by 6s. a ton. On the Mayor pointing out that this would be limited by the recent Act to 4s., the proposal was referred back to the committee.

St. Thomas R.D.C.—An application by the surveyor, Mr. Madge, for an allowance towards the purchase and upkeep of a small motor car was referred to committee. The surveyor said he had been very unwell during the past month, and his doctor had informed him that the chief cause of his indisposition was continual motor cycling. The chairman said a motor car would afford the surveyor much more protection than a motor cycle. It was becoming general for all road surveyors to have motor cars, and at Tiverton the surveyor was made an allowance of £50 a year for his car.

Uckfield R.D.C.—Reporting upon the proceedings of the recent road conference, the surveyor, Mr. A. L. Robinson, stated that interesting and informative papers were presented and discussed. Among other things, good points were brought up with regard to road foundations. A thorough knowledge of local conditions was considered essential, the proper drainage of the subsoil upon which the roads were constructed, and an adequate and suitable foundation were emphasised in their relation to the success or non-success of road surfacing and maintenance. The increased wear and tear of modern traffic had compelled the more serious study and consideration of this question by reason of the heavy damage caused to roads where a clayey subsoil or otherwise unstable foundation exists. The enormously increased cost of upkeep caused by such heavy self-propelled traffic, and in its "foreign" features the unfair burden which it casts upon certain local authorities was, however, now being prominently brought forward, and bids fair, he thought, to bring about some equitable adjustment of the heavy expense now entailed.

Worthing T.C.—The council have decided to apportion the owners in Grand-avenue, and make up the thoroughfare according to the terms of settlement agreed upon.

SEWERAGE AND SEWAGE DISPOSAL.

Gillingham T.C.—The Works Committee have approved a scheme for dealing with the whole of the sewage from Government property in the district, and advise the council to inquire if the authorities would be prepared to connect up provided the council laid the main sewer.

Haslemere U.D.C.—The surveyor, Mr. H. V. Snook, has prepared a scheme for the improvement of the sewage disposal works, the estimated cost of which is £870.

Lowestoft T.C.—The borough surveyor, Mr. G. H. Hamby, has received instructions to carry out the No. 2 out-district sewerage scheme, at an estimated cost of £862. Besides providing for the drainage of a new factory, the scheme will do away with seventeen cesspools.

Melton Mowbray R.D.C.—The tender of Mr. J. Doubleday, Waltham, at £239, has been accepted for carrying out the first portion of the Long Clawson sewerage scheme.

Newry No. 1 R.D.C.—Plans, specifications, and estimates were submitted last week of the proposed new sewerage scheme for Rathfriland. The clerk said that the estimated cost was £3,054, as compared with £2,500 at the last monthly meeting. The engineers explained that the increase was due to the fact that the prices of pipes, cement, and materials in general were continually rising in consequence of the war. Mr. John Toman, J.P., said it was absolutely essential that the scheme should be carried out as soon as possible, and it was unanimously decided that the plans, with an application for sanction of a loan, should be transmitted to the Local Government Board.

Rugby R.D.C.—The surveyor, Mr. T. W. Willard, has prepared a scheme of sewerage for Bilton, which was submitted to the Local Government Board, who have deferred the raising of the loan of £3,000 required for the work until after the war.

St. Albans T.C.—A favourable report has been submitted of the working of the sewage farm for the twelve months ended June 30th, a councillor stating that he was impressed with the efficient manner in which it was managed. The following crops were growing on the farm: Rye grass, potatoes, winter oats, and mixed vegetables.

WATER, GAS, AND ELECTRICITY.

Brigg U.D.C.—The council have referred to the Sanitary Committee a scheme prepared by Mr. Butterick, engineer, for supplying Ulceby with water.

The scheme includes the sinking of a 6-in. bore into the chalk at an estimated depth of 200 ft., the construction of a reservoir with a capacity of 33,000 gallons, and the laying of 4-in. mains at a cost of £1,100.

Brighton T.C.—The profit of £3,294 on the working of the water undertaking has been transferred to the borough fund.

Coventry T.C.—A scheme has been approved for the provision of electricity extensions at an estimated cost of £91,417.

Kingston (Surrey) T.C.—The municipal electricity undertaking again shows a deficit on the year's working, on this occasion £1,295, making with previous losses a total of £18,120. The revenue was equal to 3·154 per unit sold, as compared with 2·978 per unit in the preceding year. As it was anticipated that coal would during the twelve months from March 31st last cost about £640 more, the gross deficit for this year might be £2,289, but it was hoped this would nearly be met by the new scale of charges adopted last week. It is interesting to note that the Diesel oil engines had been running throughout the year, and had produced 855,801 units at a fuel cost of £1,513, or 0·424d. per unit, while the steam plant generated 306,200 units at a fuel cost of £2,300, or 1·802d. per unit.

Market Drayton U.D.C.—The council have entered into a contract with a local electric light company for street lighting purposes.

Settle R.D.C.—Proposals for a water supply to Tatham, at an estimated cost of £300, have been referred to the local committee for consideration.

Wimbledon T.C.—The electric lighting works have shown a nett profit of £2,184 for last year, as compared with £3,471 for the preceding year.

Wolverhampton T.C.—It has been agreed to purchase 2 acres of land at Bushbury Hill for the construction of a reservoir.

PERSONAL.

Mr. H. Chubb, surveyor to the East Kerrier Rural District Council, has resigned.

Mr. B. Jenkins, Taff's Well, has been appointed assistant surveyor to the Caerphilly Urban District Council.

Mr. John J. Kelly, of Killeenadeema, has been appointed engineer to the Loughrea Rural District Council.

Mr. Wilfrid J. Goode, engineer and surveyor to the Buckfastleigh Urban District Council, Devon, has been appointed surveyor to the Street, Somerset, Urban District Council.

Mr. D. Roberts, borough surveyor of Lewes, was on Wednesday granted an honorarium of £50 in respect of extra services in connection with the corporation's sewage disposal scheme.

Mr. Arthur Ernest Bonham, sanitary inspector to the Exeter City Council, has received permission to accept a commission in the R.A.M.C., with a view to organising a unit for sanitation work.

Mrs. Rush Dixon, widow of the late borough engineer of Woolwich, has been voted by the borough council a special grant of £100 in consideration of the large amount of extra work which Mr. Rush Dixon had been called upon to perform during the past year, and which, it was stated, had undoubtedly seriously affected his health.

Mr. Alfred Dryland, the county surveyor of Surrey, who had been ordered a complete rest, was, at a meeting of the county council last week, granted an extra month's leave in addition to his summer vacation, and if not restored to health further leave will be given. It is satisfactory to add that, in the opinion of a specialist, a couple of months' rest should completely restore Mr. Dryland's health. In his absence Mr. Frank Grove, the assistant county surveyor, has been authorised to sign all documents for him.

Mr. Harley Heckford, borough surveyor of Poplar, and Mr. T. W. A. Hayward, borough surveyor of Battersea, have been invited by the Metropolitan Boroughs Standing Joint Committee to give evidence on behalf of the London borough councils before the Departmental Committee on Locomotives and Heavy Motor Cars. Mr. Heckford has been asked to collect information from the boroughs on the north side of the Thames, and Mr. Hayward to obtain similar information from the boroughs on the south side; so that the evidence to be given by them will embrace the whole of London.

Mr. P. E. Harvey, ASSOC.M.INST.C.E., assistant borough surveyor of Worthing, has been granted permission to take up a commission in the Royal Engineers, and he will be allowed half salary for a period of six months. The borough surveyor, Mr. F. Roberts, reported that he would be able to make arrangements for the performance of Mr. Harvey's duties, but it would entail additional work on the remaining staff and some overtime work. It might also be necessary to obtain occasional temporary assistance, but the cost would be inconsiderable, and the arrangement on the whole would effect a financial saving.

Mr. H. Hughes Oakes, surveyor to the Ventnor Urban District Council, was, at the last meeting of the council, the subject of very eulogistic remarks. On the outbreak of war, owing to the clerk to the council being called up on military duty, Mr. Oakes was unanimously appointed clerk to the council in addition to his ordinary duties. The auditor's report for the past year, which was read at the meeting, concluded as follows: "I wish to record my appreciation of the excellent manner in which Mr. Oakes prepared and presented the accounts for audit in the absence of your clerk on war service." The chairman of the council stated that he fully endorsed these remarks.

Mr. George A. Hart, sewerage engineer of Leeds, an interesting address by whom on the main sewerage and sewage disposal works of that city was reported in our issue of last week, received his technical training at Manchester Technical School and Owens College, Manchester. After serving an apprenticeship in mechanical engineering with Messrs. C. Walmsley & Co., Ltd., Atlas Ironworks, Elton, Bury, Lancs, passing through the pattern making, fitting and erecting shops, he became a pupil in the drawing office of the engineer of the Lancashire and Yorkshire Railway Company, acting for four years as engineering and surveying assistant on the headquarters staff at Manchester. In 1897 he designed and carried out extensions of buildings, machinery &c., for the North of Ireland Paper Mill Company, Limited, at Larne, County Antrim, the work including the provision of a water supply from the river Inver. Subsequently he was engaged for two years as engineering assistant to the borough engineer of Salford (the late Mr. Joseph Corbett), being occupied in the design of sewage works extensions, and acting as resident engineer in charge of the construction of the work. Later he was engaged upon the main sewerage scheme for the borough of West Hartlepool, preparing the details of design, drawings, quantities, &c., for Mr. J. W. Brown, M.INST.C.E., the borough engineer and surveyor. In 1900 Mr. Hart was appointed chief assistant to the engineer of the Birmingham, Tame and Rea District Drainage Board, and was engaged for five years in connection with the construction of the sewage purification works of the city of Birmingham and other local authorities comprised within the area of the board's administration. In 1905 he was appointed sewerage engineer to the city of Leeds, and designed the scheme of sewage purification and main sewerage for the city, which was promoted in Parliament in 1908, and which is now in process of construction at Thorpe Stapleton. He is responsible to the city council for the general management and effective control of four existing sewage works, and for supervising the upkeep of works for treating and regulating the flow of liquid trades wastes into the city sewers. He is a member of the Institution of Civil Engineers, the Institution of Municipal and County Engineers, and the Royal Sanitary Institute.

MR. GEORGE A. HART, M.INST.C.E.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not becoming more and more evident that the problem of housing the "poorer class" will never be solved so long as it is left to local authorities to deal with? Is not the question one of such gigantic proportions and so implicated with social economic difficulties that, except for some of our larger cities, the solution of the problem is practically impossible? Is it not to be hoped that after the war this problem will be dealt with in some more practical manner than obtains at present?

* * * *

Why is it so much more difficult to make up one's mind to scrap "manners and customs" than it is to scrap machinery? How many years was it before this country woke up to the fact that the monastic system was not all that could be desired in the interests of progress? Are we not still blindly groping our way through conventionism without realising that many of our beaten paths have worn themselves into grooves which have become so deep that we cannot see our surroundings?

* * * *

Are there not some very interesting figures given by Mr. J. C. Davies in his article on "Coal Smoke" in the last issue of the "Journal" of the Royal Sanitary Institute? Do we realise that on the outskirts of Keighley the soot that fell was carefully measured by Mr. Davies, and that something like 5,000 lb. fell on one acre of land in a year? When we consider that this waste of carbon is going on at the same rate all over the country, should we wonder at the cost of our coal bill? When shall we recognise that prevention of waste means the acquisition of wealth, and that some day waste of anything will be looked upon as a crime?

* * * *

What is a "new building"? Is it not a fact that ever since the Public Health Act, 1875, came into force, legal disputes have constantly arisen with regard to this question? Has the recent decision of the Court of Appeal, in the case of *Rex* v. *Foots Cray Urban District Council*, settled this knotty question, or will the courts, as before, be appealed to over and over again as new cases of dispute arise?

* * * *

Is not the urban district council of Redruth to be congratulated on its attitude in regard to the complaint of certain members going behind the surveyor's back in asking questions of the workmen? Was not one member right when he said that "if he were surveyor he would dismiss any employee who was given to talking"? Was it not also refreshing to find that the chairman disapproved of the manner in which the surveyor was plied with questions in open council? How many surveyors are metaphorically placed on the rack once a month at council meetings by members who seem to vie with each other in cross-examining them about trivialities?

* * * *

Would it not be well if we could have some official pronouncement as to what is the best method of applying tar to the surface of our roads? What, for instance, are the advantages or disadvantages of tar-spraying by hand machines or mechanical-pressure machines? Or is it better to pour the tar on the road from properly constructed cans, and then brush or squeegee the tar over the surface? Or is it better to tar the surface as one would a gate—by hand brushes dipped into hot tar?

* * * *

Is it not to be hoped that the present feeling against unnecessary expenditure by local authorities in war-time will become a habit that will survive the war? Has not an excellent example been lately set by the Metropolitan Asylums Board, who have reduced their estimates for painting and cleaning for the current year from £21,000 to £5,000, representing an economy in one item of expenditure of over 75 per cent.?

1st London Sanitary Company, R.A.M.C.T.

Further recruits are required for the above company, as several detachments have been sent to the Front, and members and associates are invited to join. Pay is at the usual Army rates, with corps pay according to proficiency; separation allowances at the usual rates. Applications should be made, either personally or by letter, to the commanding officer of the company, at Duke of York's headquarters (Turk's-row entrance), Chelsea, S.W.

FOR OTHER ADVERTISEMENTS

See End of Paper.

COUNTY BOROUGH OF WEST HAM.

TRAMWAYS DEPARTMENT.

ASSISTANT CIVIL ENGINEER AND SURVEYING ASSISTANT.

The Council invite applications for the following positions on the staff of the Tramways Department:—

(*a*) Civil Engineering Assistant. Salary, £250 per annum.

(*b*) Surveying Assistant. Salary, £117-£120 per annum.

CIVIL ENGINEERING ASSISTANT:—

Applicants must be fully qualified civil engineers, with practical experience in the construction and maintenance of tramway permanent way, and be accustomed to the control and management of considerable numbers of men.

SURVEYING ASSISTANT:—

Applicants must be competent surveyors and levellers, quick, accurate and good draughtsmen. Experience in the preparation of plans, sections, and details in connection with tramway work an advantage.

Application must be made on the official form, which may be obtained from Mr. J. S. D. Moffet, General Manager, Tramway Offices, Greengate-street, Plaistow, E., and must be delivered at my Office not later than 12 noon on Saturday, 28th August, 1915.

GEO. E. HILLEARY,
Town Clerk.

Town Hall,
West Ham.
August 3, 1915. (2,664)

COUNTY BOROUGH OF WEST HAM.

TRAMWAYS DEPARTMENT.

GENERAL FOREMAN AND FOREMAN PLATELAYER.

The Council invite applications for the following positions on the staff of the Tramways Department:—

(*a*) General Permanent Way Foreman. Wages, £3 5s. per week.

(*b*) Foreman Platelayer. Wages, £2 5s. per week.

(*a*) Required, a General Permanent Way Foreman, thoroughly experienced in every branch of permanent way work and road construction, and capable of executing special work expeditiously and accurately. Applicants must have held a similar position, or had experience in a similar capacity, on engineering contracts of a corresponding nature.

(*b*) Required, a Foreman Platelayer, accustomed to the construction and lay-out of complicated junctions, curves, and other special tramway track work, and generally acquainted with modern practice in track construction and maintenance, including rail welding. Applicants must be capable of rapid and accurate work in the renewal of junctions, &c., and have had experience in the handling of temporary track. Only qualified platelayers need apply.

Application must be made on the official form, which may be obtained from Mr. J. S. D. Moffet, General Manager, Tramway Offices, Greengate-street, Plaistow, E., and must be delivered at my Office not later than 12 noon on Saturday, 28th August, 1915.

GEO. E. HILLEARY,
Town Clerk.

Town Hall,
West Ham.
August 3, 1915. (2,665)

FAREHAM RURAL DISTRICT COUNCIL.

TENDERS FOR MACADAM.

Tenders are invited by the above Council for the Supply of Granite, Basalt, or other Hard Stone, required for the year ending March 31st, 1916.

Form of Tender may be obtained on application from the undersigned.

Tenders, sealed and endorsed "Tenders for Macadam," together with samples of Stone, to be delivered to me on or before 16th August, 1915.

The Council do not bind themselves to accept the lowest or any Tender.

J. F. WHITEAR,
Surveyor.

Southampton-road,
Fareham, Hants. (2,663)

TARRED AND SLIPPERY ROAD SURFACES.

A NEW MODE OF RAPID GRITTING.

When persons, be they motorists, horse drivers or pedestrians, find that, in order to reach their destination, they must pass over a newly tarred road, with the tar in a semi-liquid and sticky condition, there is some excuse for them being irate and anathematising road authoritites and their surveyors.

Such experiences, unfortunately, seriously militate against the employment of tar for improving road crusts. Yet the trouble is easily avoidable by immediately and adequately covering the sticky tar with gritting.

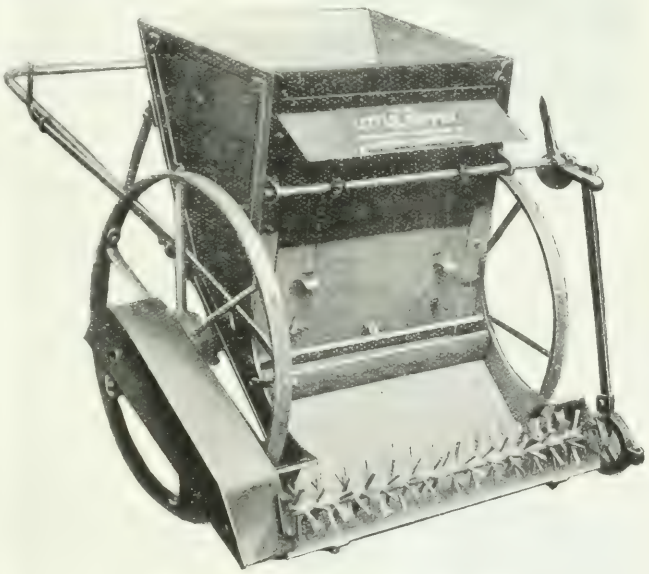
Manual labour is seldom really efficient for this work; men do not spread the grit evenly. Ridges are consequently formed, and the round and larger particles are apt to be thrown or to roll towards the roadside, thus becoming useless for their purpose.

The paramount objection, however, to hand labour for such work is its slowness and consequent costliness. Rapidity is all-important if successful results are to be ensured by properly embedding the gritting in the tar while the latter is in a plastic condition. This desideratum is now easily obtainable by the employment of a specially devised machine, the outcome of numerous experiments carried out under the guidance of well-known experts in road engineering.

This machine is manufactured by Messrs. Prewett & Wettern, Limited, of 16 Water-lane, E.C., and under the name of the "Little Nipper" patent gritting machine is now available for use.

Its action is so clearly shown in the illustration as to leave little to explain. Constructed on simple and thoroughly practical principles, strongly made in mechanism and structure, this machine is thoroughly practical and efficient, and can be worked by one man alone. It gives an absolutely even distribution of the gritting material over a width of 2 ft. 8 in. (machines distributing to a greater width are also obtainable). By being distributed evenly the grit has greater covering capacity as well as increased durability.

The hopper having been filled, the feed-gate at the bottom of the hopper is opened. The control handle is conveniently placed at the right hand of the worker, and the quantity can be regulated or shut off at will. From the feed-gate the chippings slide by gravity to the flicker-screw, which has a right and left hand travelling motion, and is actuated by the rotation of the wheels. Thus the chippings are wheeled and spread by the same operation, and no gritting falls unless the machine is in motion.



The "Little Nipper" Gritting Machine.

One notable feature is that the wheels do not run on the tar, but on the grit which has been flicked in front of them. Again, the distribution is close to the ground, therefore the grit does not roll away.

The machine is equally efficient for gritting greasy wood paving to prevent slipping and skidding.

The economic value of labour-saving implements is made doubly important by the present acute shortage of trained and reliable workmen, and is emphasised when it is considered how such machines tend to lessen the burden of the statutory charges for employers' liability, health assurance, and the like.

Who was the Victim?—According to the *Daily Mirror* a zealous young subaltern thought a theodolite was a camera, and arrested the surveyor who was using it for taking road levels for using it for photographs in a prohibited area. This actually happened "not a million miles from Aldershot."

SOME RECENT PUBLICATIONS.*

Working Data for Irrigation Engineers. By E. A. Moritz. Price 17s. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

Although not a "pocket-book" in form, this work is arranged according to the usual plan of engineering "pocket-books." Being devoted, however, to the single subject of Irrigation, it follows that the information given is rather fuller than usual for such works. The principle of practical utility has been kept steadily in view, the greater part of the book consisting of tables and diagrams. Before entering on a detailed explanation of these tables and diagrams, the author discusses briefly the various features of irrigation engineering, in order to show more completely the applicability of the matter that follows. To this end, the usual steps in the development of an irrigation project are taken up in the order of their sequence, and data are presented that are of assistance in arriving at the proper conclusions. Thus, the earlier chapters deal with the subjects of Examination and Reconnaissance, Investigations and Surveys, and the Design of Irrigation Structures. Then follows a series of hydraulic diagrams and tables, and one of structural diagrams and tables. Miscellaneous tables and data are comprised in a separate chapter, while the final section treats of specifications. The whole forms a most useful work of reference for irrigation engineers.

Elementary Chemical Microscopy. By E. M. Charnot. Price 12s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

The author of this work is the Professor of Sanitary Chemistry and Toxicology at Cornell University, and being convinced of the necessity for including in his curriculum a course in the manipulation and applications of the microscope, he instituted a series of lectures and demonstrations, upon the notes for which the work is based. It is intended primarily for students in elementary chemical microscopy, and as a basis for more advanced work in specific fields. With this avowed limitation, the work is sufficiently comprehensive, and is illustrated by drawings of exceptional clearness.

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

* Any of the publications reviewed or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

A COLLAPSIBLE HOOD FOR MOTOR OMNIBUSES.

Weather protection for the upper decks of motor 'buses is something which is badly wanted. When the motor 'bus made its advent the centre of gravity and other things did not permit of a hood. Since then the whole design of the 'bus has been altered, with the result that to-day there is little improvement that can be made, and the centre of gravity is as low as it can possibly be.

The public has been educated to 'bus travel by the various companies having maintained a quick, reliable and continuous service. In wet weather, therefore, the public is greatly inconvenienced; this is accentuated at the present time owing to the services being reduced for Government wants. In spite of all this, it is safe to say that a permanent fixture on the top of the omnibus would not be popular with

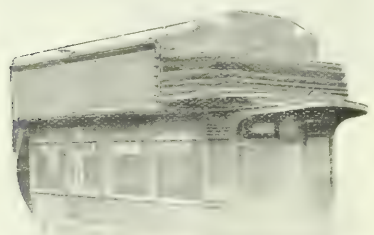
The Beck 'Bus Hood When in Use.

those who prefer to travel outside, as then the view would be obstructed, and the passengers cheated of fresh air.

For these and other reasons the illustrations as given on this page should be of public interest.

Here is a hood which is only in evidence when wanted, and is a complete protection against weather. When not in use the hood rests over the driver's canopy. It can be raised or lowered in thirty seconds, and the whole, both in construction and working, is so simple that it can be operated easily by one man.

When the hood is in use there is sufficient head-



The Beck 'Bus Hood When Not in Use

room for passengers to walk comfortably to their seats. There is nothing to get in the way of passengers; there is nothing to get out of order.

The hood can be fitted to any existing motor omnibus without alteration to the vehicle.

Apart from the question of public convenience which such a hood would mean, proprietors of omnibuses will do well to consider its merits, as eighteen outside seats, in addition to sixteen inside seats, continually filled is very attractive from a revenue point of view.

The inventor and patentee of the hood, Mr. Frank Beck, will give, towards the end of this month, a practical demonstration by running two or more 'buses, fitted with the hood, 25 miles or so into the country from London.

Mr. Beck extends to all omnibus proprietors, municipal and otherwise, in the provinces and elsewhere, an invitation to view what will be the fullest test that a hood can have, and all those who wish to avail themselves of this opportunity or would like fuller particulars should write to Mr. Frank Beck, The Willesden Paper and Canvas Works, Willesden Junction.

DEPTFORD SLIPPER BATHS.

These new buildings, the accommodation in which is eighteen baths and water-closet, were opened by the Mayor last week.

On the first floor a spacious flat, containing a large living-room, two bedrooms and a kitchen-scullery, is provided for the superintendent. The basement is utilised for the boiler, fuel, and storage of hot water.

The entrance to the baths is at the corner of Ilderton-road and Stockholm-road, and gives direct access to a tastefully designed octagonal-shaped hall, adjoining which there is a comfortable waiting-room and office and store with pay-desk.

The bath-rooms are tiled from floor to ceiling, and everything has been done to reduce the cost of maintenance.

The architects are Messrs. Joseph & Smithem, 83 Queen-street, Cheapside, and the contractors Messrs. W. S. Barton & Co., of Chancery-lane.

The following sub-contractors were concerned with the work: Artificial stonework, asphalt, and granolithic paving, Messrs. A. C. W. Hobman & Co., Limited; fireproof floors, Messrs. H. W. Cullum & Co., Limited; tiling, Messrs. Pilkington's Tile and Pottery Company, Limited; baths, Messrs. Shanks & Co.; hot-water installation, Messrs. J. & W. Nicholson & Co.; electric light installation, Electrical Installations, Limited.

LOCAL AUTHORITIES' EXPENDITURE.

In the House of Commons, the President of the Local Government Board was asked to state the total annual expenditure of local authorities in England and Wales for the past three years.

Mr. Long, in replying, said the information was not yet available for the year ended March 31st last, but that for the preceding three years the figures were as follow:—

—	Expenditure not defrayed out of loans.	Expenditure defrayed out of loans.
	£	£
Year ended 31st March, 1912	134,073,000	16,890,000
Year ended 31st March, 1913	140,337,000	18,079,000
Year ended 31st March, 1914	145,650,000 (approximate figure)	21,000,000 (approximate figure)

The above figures include the large expenditure on reproductive undertakings, such as tramways.

Bristol Corporation and Superannuation. — At a meeting of the Bristol Health Committee last week, Mr. Thorne moved a resolution that the appointment of Mr. Kirley as chief inspector should be determined, but that his services should be retained as consulting inspector at a salary of £70 a year. He said Mr. Kirley had had between fifty and sixty years' service, and he had faithfully performed his work. Mr. Jones hoped that some scheme of superannuation would be evolved for their corporation officers. The chairman, Dr. Colston Wintle, said he agreed that there should be some system of pension or superannuation. After a man had served the corporation for forty or fifty years he did not like them having to appoint him in a consulting capacity, because there was no superannuation. He suggested that a sub-committee should go into the matter. Mr. Moore thought that the council some time ago appointed a committee to go into the question of the superannuation of their officers. He should like to testify to the very valuable services rendered by Mr. Kirley. After further discussion, it was agreed to refer the question of superannuation to a sub-committee, and Mr. Thorne withdrew his resolution.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. H. T. Wakelam, M.Inst.C.E., County Engineer of Middlesex.

EASTERN SUB-DISTRICT (NORFOLK, SUFFOLK AND CAMBRIDGE).

Mr. Robert Croome, the engineer and surveyor to the Cromer Urban District Council, has arranged to have a sub-district meeting at Cromer on Saturday, August 21st.

12.30 p.m.—Meet at the council offices.

Business.

Discussion on the question "How to put more life into the Eastern Sub-District."

Discussion on a short paper on "Road Tarring."

John R. Mead,
Hon. District Secretary.

Ipswich.

It is hoped to be able to arrange with Mr. W. Lionel Jenkins, the county surveyor for West Suffolk, to have a sub-district meeting at Bury St. Edmunds in the near future.

ROYAL SANITARY INSTITUTE.

PROVINCIAL SESSIONAL MEETING, BRIGHTON.

A sessional meeting will be held on Friday and Saturday, September 3rd and 4th, in the Permanent Art Gallery, Brighton, at 10.30 a.m., when discussions will take place on "Indian Sanitation," "Camp Sanitation," and "The Final Report of the Royal Commission on Sewage Disposal."

The chair will be taken each day at 10.30 a.m. by Sir Henry Tanner, C.B., I.S.O., F.R.I.B.A. (chairman of the council of the institute). Vice-chairmen: H. Percy Boulnois, M.Inst.C.E., Louis C. Parkes, M.D., D.P.H., Colonel J. Lane Notter, M.A., M.D., R.A.M.C.

Tickets for admission of visitors may be had on application to Dr. Duncan Forbes, medical officer of health, Town Hall, Brighton, who is kindly acting as the local hon. secretary of the meeting; and of E. White Wallis, secretary.

Programme.

Friday, September 3rd.

10.15 a.m.—His Worship the Mayor (Alderman J. L. Otter, J.P.) will welcome the members of the institute to Brighton.

10.30 a.m.—Discussion on "Indian Sanitation."

1—"Sanitary Problems in Hospitals for Indian Troops in England," by Major S. P. James, M.D., I.M.S., the Kitchener Hospital, Brighton.

2—"The Use of Storm-water Drains to Ensure Safe Water Supplies being Obtained from Polluted Catchment Areas," by Major C. C. Murison, I.M.S., staff officer, the Kitchener Hospital.

12 noon.—Discussion on "Camp Sanitation" to be opened by Lieut.-Colonel H. R. Kenwood, M.B., R.A.M.C.

2.30 p.m.—Visit to the Kitchener Indian Hospital. The party will assemble at the North Gate of the Royal Pavilion, close to the library, and will proceed by car.

3 p.m.—Visit to the Royal Pavilion Indian Hospital. The party will assemble at the North Gate of the Royal Pavilion, close to the library.

8.30 p.m.—Reception by his Worship the Mayor at the Permanent Art Gallery.

Saturday, September 4th.

12 noon.—Discussion on "The Final Report of the Royal Commission on Sewage Disposal" to be opened by Samuel Rideal, D.Sc., F.I.C., and J. D. Watson, M.Inst.C.E. (engineer to the Birmingham, Tame and Rea District Drainage Board).

2.30 p.m.—Visits will be made to Shoreham Camp and the Brighton electricity works.

STUDENTS' LECTURES.

The fifty-ninth course of lectures and demonstrations for sanitary officers will commence on Monday, September 20th.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

ROAD FOREMEN.—August 9th.—Swadlincote Urban District Council. 32s. 6d. per week.—Mr. J. Mason, engineer and surveyor.

DESIGNER AND DRAUGHTSMAN.—August 11th.—Victorian State Railways. £350 per annum.—Agent-General for Victoria, Melbourne-place, Strand, W.C.

WORKING HIGHWAY SURVEYOR.—August 14th.—Keighley Rural District Council.—Mr. J. N. Clarkson, 40 North-street, Keighley.

SURVEYOR, INSPECTOR AND COLLECTOR.—August 23rd.—Buckfastleigh Urban District Council. £150 a year.—Mr. E. Windeatt, clerk, 19 High-street, Totnes.

SURVEYOR.—August 23rd.—Halesowen Rural District Council. £160 per annum.—Mr. E. H. Grove, clerk, Church Steps House, Halesowen.

MECHANICAL ENGINEER AND FOREMAN.—August 24th.—Corporation of Bedford. £2 10s.—£3 per week.—Mr. N. Greenshields, borough engineer and surveyor, Town Hall, Bedford.

CHIEF STOREKEEPER.—August 30th.—Corporation of Birmingham. £156 per annum.—Mr. Henry E. Stilgoe, city engineer and surveyor.

ELECTRICAL ENGINEER.—September 1st.—Corporation of Sutton Coldfield. £250 a year.—Mr. R. A. R. Nadin, town clerk, Council House.

GENERAL ASSISTANT.—Mr. J. Anstee, district surveyor, Commercial-road, Guildford, Surrey.

DRAUGHTSMEN.—Nigerian Government Railway. £300–£350.—Crown Agents for the Colonies, Whitehall-gardens, S.W.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

DUNDEE.—August 7th.—For the construction of the columns, beams and floors forming the reinforced-concrete framework of the superstructure of the city hall, for the corporation.—City Architect, City Hall.

WOKING.—August 9th.—For the construction of a bridge over the Basingstoke Canal, for the urban district council.—Mr. G. J. Wooldridge, engineer and surveyor.

MERTHYR.—August 9th.—For the erection of 160 workmen's dwellings, for the corporation.—Borough Architect, Town Hall.

DONCASTER.—August 9th.—For the erection of a public convenience, for the corporation.—Mr. F. O. Kirby, borough surveyor.

BRADFORD.—August 11th.—For the erection of hospital buildings, for the corporation.—City Architect, Town Hall.

SALISBURY.—August 13th.—For the extension of the sorting office, for the Public Works Commissioners.—Postmaster, Head Office, Salisbury.

ESSEX.—August 14th.—For the extension of a sanatorium, for the county council.—County Architect, Shire Hall, Chelmsford.

Engineering: Iron and Steel.

WOKING.—August 7th.—For the construction of a bridge, for the urban district council.—Mr. G. J. Wooldridge, engineer and surveyor, Council Offices.

ALNWICK.—August 9th.—For providing and laying 780 yds. of 4-in. cast-iron socket pipes, and alternatively of weldless steel tubes, for the rural district council.—Mr. H. W. Walton, clerk.

GRIMSBY.—August 9th.—For the supply of a petrol motor fire engine, for the corporation.—Chief Officer, Central Fire Station.

RANGOON.—August 11th.—For the installation of a system of fire alarms, for the municipality.—

Messrs. Ogilvy, Gillanders & Co., 67 Cornhill, London, E.C.

WIGAN.—August 12th.—For the supply of 50 tons of tramway rails, 150 cranked tie-bars, and 20 pairs of fishplates, for the corporation.—Mr. A. T. Gooseman, borough engineer, King-street, West Wigan.

BRISTOL.—August 23rd.—For the supply of a 6,000-kw. three-phase steam turbo-alternator, with condensing plant, for the Electrical Committee.—Mr. H. Faraday Proctor, chief engineer, The Exchange, Bristol.

RICHMOND, N.S.W.—September 6th.—For the supply and erection of two units, each consisting of a centrifugal pump and electric motor, for the Metropolitan Board of Water Supply and Sewerage, Sydney. —Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Roads.

HASLEMERE.—August 9th.—For the supply of 700 tons of broken granite, for the urban district council.—Mr. Howard V. Snook, Council Offices, Haslemere.

PAIGNTON.—August 9th.—For making up a road under the Private Street Works Act, for the urban district council.—The Surveyor, Town Hall.

CHESHUNT.—August 10th.— For the supply of broken granite, sand and shingle, for the urban district council.—Mr. J. E. Sharpe, engineer and surveyor, Manor House, Cheshunt.

LONDON.—August 10th.—For repairs to the carriageway of Blackwall Tunnel, for the county council. Chief Engineer, Spring-gardens, S.W.

HARTLEY WINTNEY.—August 17th.—For the supply of steam road rollers, for the rural district council. —Mr. J. R. Listerson, surveyor, Fleet, Hants.

EPSOM.—August 23rd.—For the supply of 8,000 tons of broken granite, 500 tons of ¾-in. granite chippings, and 200 tons of ¼-in. granite chippings, for the rural district council.—Mr. T. E. Ware, surveyor, Waterloo-road, Epsom.

LAMBETH.—August 25th.—For the supply of Aberdeen granite paving setts, broken granite, broken flints, gravel, ballast, and tools, for the borough council.—Mr. H. Edwards, borough engineer, Town Hall, Brixton-hill, S.W.

Sanitary.

ASHINGTON.—August 9th.—For cleansing ashpits and privies, for the urban district council.—Mr. G. Beaty, surveyor, Council Chambers, Ashington, Northumberland.

DRIGHLINGTON. — August 9th. — For cleansing closets and ashpits, for the urban district council.— The Surveyor.

ETON.—August 10th.—For scavenging in the parish of Horton, for the rural district council.—Mr. C. P. Summerhayes, clerk, Fairview Villas, Colnbrook.

ADWICK-LE-STREET.—August 11th.—For sewerage works and surface-water drainage, for the urban district council.—Mr. G. Gledhill, surveyor, Council Offices.

GLASTONBURY.—August 13th.—For laying a main sewer and constructing manholes, for the corporation. —The Borough Surveyor.

TADCASTER.—August 14th.—For emptying ashpits in several townships, for the rural district council.— Mr. H. M. Driver, sanitary inspector, Garforth, near Leeds.

ASHBY WOULDS.—August 14th.—For laying cast-iron and stoneware pipe sewers, and constructing manholes, for the urban district council.—Mr. H. Walker, consulting engineer, 408 Mansfield-road, Nottingham.

BUNGAY.—August 16th.—For house scavenging, for the urban district council.—Mr. P. J. Sprake, clerk.

EARBY.—August 16th.—For the extension of sewage disposal works, for the urban district council. —Mr. J. E. Aldersley, engineer and surveyor, Council Offices.

QUEENSTOWN.—August 31st.—For works of drainage, for the General Hospital.—Mr. J. Aberne, surveyor.

Stores.

ROCHESTER.—August 31st.—For the supply of tools, horse hire, Portland cement, brooms, oils, road metal, and coal, for the corporation.—Mr. W. Banks, city surveyor, Guildhall.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.
‡ Provisionally accepted.

BROWNHILLS.—For laying 9-in. stoneware pipe sewer, for the urban district council.—Mr. J. H. Shaw, engineer and surveyor :—

Curral, Lewis & Martin, Birmingham	£798
Martin & Element, Smethwick	771
Lewis & Taplin, Birmingham	694
W. Thorpe, Birmingham	629
C. Jackson, Tipton, Staffs *	588

CARSHALTON.—For the supply of 200 tons of 2½-in. and 100 tons of 1½-in. tarred slag macadam, for the urban district council.—Mr. W. Willis Gale, surveyor :—

Constable, Hart & Co., Limited, Eastcheap, E.C., 17s. 9d. and 18s. 9d.
Tarmac, Limited, Victoria-street, S.W., 17s. 10d. and 18s. 4d.
J. Wainwright & Co., Limited, Shepton Mallet, 17s. 9d. and 18s.
Clarmac, Limited, Central Buildings, S.W., 17s. 9d.*
J. J. Stonehouse & Co., Limited, Cardiff (informal), 8s. and 10s.

ELLESMERE PORT.—For the supply of 900 yds. of gas mains and excavation work, for the urban district council :—

Pipes.—Stanton Ironworks Company, Limited, Chesterfield.
Excavation Work.—E. B. J. Gould, Ellesmere Port.

RIPON.—Accepted for the erection of public conveniences, for the corporation :—

T. Webster, Bondgate, Ripon.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

AUGUST.

21.—Institution of Municipal and County Engineers: Eastern Sub-district meeting at Cromer.

APPOINTMENTS OPEN.

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THE RURAL DISTRICT COUNCIL OF HALESOWEN.

APPOINTMENT OF SURVEYOR.

Applications are invited for the post of Surveyor for the Rural District of Halesowen, which comprises nine parishes.

There are about 26 miles of district roads to be superintended and maintained.

The Surveyor will be required to devote the whole of his time to the duties of his office, to provide himself with means of locomotion, and to reside in the district.

Candidates must be fully competent to perform the duties of the post, to prepare plans and specifications, to take levels, to keep in order the sewers, to superintend the making of house connections to sewers, to prepare Town Planning Schemes, to see that the by-laws of the Council are properly carried out, to keep the prescribed Accounts, and generally to comply with and carry out the instructions of the council.

The person appointed will be required to enter upon his duties as soon as possible, and to give approved security in the sum of £200 for the faithful discharge of those duties.

The salary will be £160 per annum, payable quarterly.

The appointment will be made subject to determination by three calendar months' notice in writing from either side.

Applications (marked "Surveyor"), in the candidate's own handwriting, stating age, qualifications, and previous experience, and accompanied by copies of three testimonials of recent date, must be received at the office of the undersigned not later than 12 o'clock noon on Monday, 23rd August.

Canvassing Members of the Council, either directly or indirectly, will disqualify a candidate.

(By order)

E. H. GROVE,
Clerk.

Church Steps House,
Halesowen.
August 3, 1915. (2,661)

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. AUGUST 13, 1915. No. 1,230.

Minutes of Proceedings.

Reinforced-concrete Roads and Sewers, &c.

Reinforced concrete is now in such general use for all engineering and building work that any paper dealing with it is bound to be of interest to municipal engineers, even though it is difficult to say anything very new or novel about it. The paper on this subject, read by Mr. Arthur Collins, M.INST.C.E., the city engineer of Norwich, at the annual meeting of the Institution of Municipal and County Engineers, and reproduced in this issue, did not pretend to deal with it exhaustively, but was rather intended to provoke discussion. As one would expect from an engineer of his experience, the paper contained much practical information, and not the least valuable was that relating to past failures of concrete and their causes. The effect of frost on the setting of concrete when used for foundations, piles, or piers is still often disregarded with disastrous results. The use of furnace clinkers containing sulphur is in many cases responsible for unsightly and sometimes dangerous cracks in concrete. The need for water free from vegetable or other impurities, and the avoidance of any clinker, coke breeze, or old bricks containing sulphur or free lime is also to be noted. Probably no other material in building or engineering work is so dependent for its success on good workmanship as reinforced concrete. Mr. Collins quotes an American authority as stating that 90 per cent of failures in concrete are due to poor workmanship, 8 per cent to poor aggregates, and only 2 per cent to poor cement. Occasionally we have serious failures due to faulty design. One well-known failure recently, which was admittedly due to bad design, called attention to the need for closer supervision of the local authority, and for the framing of by-laws regulating the use of reinforced concrete in buildings. Only a small number of our local authorities have adopted comprehensive regulations for reinforced concrete, and this, and to some extent the inexperience of many building inspectors with the material, is responsible for many past failures. Empirical formulæ are frequently used with more faith than knowledge, but the adoption of more scientific methods is leading to the framing of regulations which, if properly observed, will prevent to a very great extent such serious failures as have taken place in the past. The London County Council have recently issued draft regulations for reinforced concrete which embody much of the work of the Joint Committee of the Royal Institute of British Architects, the Institution of Municipal and County Engineers, and other bodies, and which will act as a model for other local authorities.

Mr. Collins's paper dealt somewhat briefly with the use of reinforced concrete in such special municipal engineering works as pile-driving, the construction of manholes, underground chambers, retaining and abutment walls, bridges, sewers, and roads, but the discussion of the paper was largely confined to its use in roads. Ordinary concrete for foundations for roads has been used fairly extensively, especially for wood or sett paved and asphalted roadways, but the use of reinforced concrete either for road foundations or surfacing is still somewhat of a novelty. Reinforcement is particularly valuable in the case of roads over colliery workings or salt mines, in treacherous soils such as peat, and in damp situations such as low-lying, swampy ground. Its use for foundations for tramway purposes, or for sett paving for heavy motor traffic, is likely to increase considerably in the near future, but it is questionable whether it is likely to be so successful as a surfacing material. In America concrete has been used extensively in recent years for road surfacing, but British surveyors are rather slow in adopting it for this purpose. Mr. W. Matthews Jones, at Chester two years ago, laid a reinforced-concrete road, 6 in. thick in the middle, and 8 in. thick at the sides, with a concrete surface, and he states that it has proved satisfactory. He intended to leave the surface untouched, but, as might naturally be expected, under traffic the surface was found to wear rather dusty, and he had to tar-spray the surface and grit it with granite chippings. A concrete surface is apt to wear either slippery or dusty, and in America considerable difficulty has been experienced with expansion of the concrete, which causes unsightly cracks. The experiments carried out by the Kent County Council on the London and Dover road have, unfortunately, not been given a fair chance of success, owing to the heavy traffic which the military authorities ran over the road before the concrete had time to set properly. There appears to be no reason why concrete should not in many cases be reinforced when used as a foundation for sett paving or bituminous carpeting, for the heavy motor traffic now on our roads calls for increased strength in the foundations. With an extended experience, many of the difficulties now met with in concrete surfacing of roads will probably disappear, but at present it appears likely that some other form of surface treatment than that of cement will be required to avoid slipperiness or dustiness.

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The Control of Water Supplies.

For some years past we have been advocating the establishment of some form of central control of the sources of our national water supply, so as to avoid the injustices which arise from the present system of competition for catchment areas and the extravagance which too frequently results from lack of co-operation between neighbouring authorities. The question is a very large one, and we are convinced that it can only be solved after a patient and exhaustive survey of past and present conditions. The recent issue as a Blue-book of a "Return as to Water Undertakings in England and Wales" may be regarded

as the first instalment of such an investigation. This return has been made in consequence of an order of the House of Commons dated as long ago as November, 1910, and the time that has been taken to compile it is a fair measure of the comprehensive nature of the information it contains. The first of the two parts into which it is divided shows, as regards every water undertaking in England and Wales, the powers under which the undertakers are authorised to supply, the limits within which the supply is authorised and the places actually supplied, the nature and sufficiency of the sources, and particulars as to the works, and the quantity and quality of the water. The second part of the return shows, as regards every district in England and Wales, the area, population, and number of houses, the number of houses having a piped service, the names of the undertakers providing a supply of water, and the source, nature, and sufficiency of the supply where there is no piped service. Prefaced to the return is a most valuable memorandum which not merely explains the exhaustive tables that follow and the conclusions that may be drawn from them, but also contains a most valuable and interesting historical survey of the water supply of the Metropolis, and also of water supplies outside the metropolitan area.

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The Water Supply of the Metropolis.

The early history of London water supply reads to-day like a romance. Although the first undertaking of any magnitude was that of the famous New River Company, about thirty years before that work was completed the London Bridge waterworks had been established through the enterprise of a Dutchman named Peter Monys. This pioneer obtained the consent of the corporation to erect a waterwheel under one of the arches of London Bridge, which, being turned by the tide, actuated pumps which sent the water through lead or wooden pipes in the streets and thence by branches into the houses. After the completion of the New River, several other undertakings were commenced, the first, which survived to modern times, being the Chelsea Company. Most of the companies were originally formed under special Acts of Parliament, but some of them derived powers also from Letters Patent. As, however, they had no statutory area of supply, competition arose between them, and for a time very low rates were charged. So keen did this competition become that in 1817 there was a partition of London into areas for water supply purposes, and a consequent increase in prices. In 1821 a Select Committee was able to report that a material improvement had taken place in the supply both in respect of abundance and certainty, and that the supply of water to London was very superior to that enjoyed by any other city in Europe. A few years later, however, the public became dissatisfied with the quality, and in 1827 a Royal Commission was appointed, and reported that many of the complaints were well founded. This report resulted in activity on the part of the companies in tapping new sources of supply, constructing new reservoirs, and installing systems of filtration. In the following year Telford was instructed "to undertake the necessary surveys with a view to the formulation of a practicable and efficacious scheme for supplying the whole of the Metropolis with pure and wholesome water." He reported in 1834, and made extensive proposals, but nothing was done. In 1849 there was an outbreak of cholera, which naturally once more directed public attention to the question of water supply, and varying suggestions were put forward by the Board of Health and the Royal Chemical Commission. It is interesting to observe that in 1851 a Bill was introduced to amalgamate all the existing companies into one, which was to be under the partial control of the Government. This scheme, however, never matured, but in the following year was passed the first general Water Act relating to London. It confirmed the companies in their functions, but introduced important provisions for their regulation, including a direct prohibition from taking water from the Thames below Teddington Lock. The next general Act was passed in 1871, and was concerned primarily with the provision of a constant supply. In 1874 the Final Report of the Rivers Pollution Commission condemned both the Thames and the Lea as sources of supply, and this was followed by several Bills embodying the principle of public control. It was not until 1902, however, that the Metropolis Water Act was passed, by which the Metropolitan Water Board was created. It was not until July, 1905, that the whole of the companies' undertakings were formally vested in the Board, the total cost of acquisition being £46,939,258.

The chief sources from which the Water Board obtain water continue to be the rivers Thames and Lea, 59·1 per cent of the total supplies being derived from the former and 23·6 per cent from the latter, while only 17·3 per cent is obtained from wells and other sources. The board's works of filtration include 172 filter beds with a total area of 170 acres, while a further 15 acres of filter beds are about to be provided. Eight patent filters have also been installed. The board possess forty-nine storage and eighty-four service reservoirs, with a total capacity of about 12,908,000,000 gallons, and when the works at present authorised are completed this total will be increased to 25,208,000,000 gallons. The average daily supply per head in 1913-14 was 36·16 gallons. The total average daily quantity of water supplied was over 244,000,000 gallons, or more than 200,000,000 gallons in excess of that supplied by the Manchester Corporation, who own the second largest undertaking in the country. With the exception of the new water supply scheme for greater New York, which is said to provide a supply of 500,000,000 gallons a day, the Metropolitan Water Board manage the largest water undertaking in the world.

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Bristol City's War Record.

It is possible to detect the effects of the war in various departments of administrative work in the report for the year ended March 25th last published recently by the city engineer of Bristol, Mr. L. S. McKenzie, Assoc.M.Inst.C.E. Mr. McKenzie's statement, in fact, may be accepted as a typical example of how the national crisis has affected the work of the borough surveyor in its many ramifications. It covers eight months under the war régime, and it opens with the familiar note with respect to the necessity of reduced expenditure as a consequence of the conflict into which the nation has been plunged. For one thing, we are told that street improvement work has been reduced to a minimum. This, if there is here and there a tendency to carry it too far—to the extent, in fact, of the neglect of work that is necessary in the public interest and health—may be justified as being alike expedient and desirable in the circumstances. Economy in municipal work should be a permanent desideratum, but there is, of course, economy and economy, even under existing conditions. Economy which is regarded as an end in itself does not ring true. It is only when it is regarded as the means to an end that it will stand the test, so far, at all events, as administrative practice is concerned. These remarks are prompted by statements made recently at the Finance Committee of the Oldham Town Council. An item of £500 was stated to be included in the expenditure of the Surveyor's Committee, and this seems to have elicited the comment by an alderman that the estimates of the various committees were in the hands of officials who did not seem to care whether money was spent or not.

It was not so much what he said as the way in which he said it that we are to judge the speaker's intention, but it is quite obvious that the point to consider in this particular instance was whether the expenditure of £500 was requisite or not whether officials indiscriminately were utterly indifferent to the public interests. This latter suggestion, if it has any basis of reality, manifestly concerns the council as much as it does the officials.

Returning to the interesting report of Mr. McKenzie, we find it records that towards the end of September the Government agents requisitioned forty-five horses belonging to the Corporation of Bristol, causing considerable dislocation in the collection of house refuse. It is satisfactory to know that the city engineer is able to testify that, while there was plenty of more lucrative work to be obtained in the city, most of the haulage contractors loyally helped him through his difficulties, some of them even sending more than the maximum number of horses specified in their contracts. It was found necessary in March to purchase twenty-one horses at an average price of £82; but the further development of the Government's act was technical as well as financial, for, owing to the scarcity of horses of the right class, which is likely to prevail for some time, it was considered necessary to order two motor rotary-brush machines, while in addition the city engineer states that the question of the adoption of electric traction for the collection of house refuse and for street watering is being carefully considered. In proof that efficiency may be quite consistent with well-ordered economy, it is recorded that the highways and sewers have been maintained in good condition generally, and this in spite of the fact that ten members of the city engineer's staff and 230 men have joined either the Navy or the Army. Tar-spraying the surface of the roads has again been extensively carried out, about 50 miles of roads being dealt with by contractors by machine work, and 87 miles by direct labour, chiefly hand work. Thus we have an example of that "business as usual" which is demanded in the interests of public health and the general convenience. It is noted, as a direct consequence we take it of the war conditions, that the number of new houses erected during the year was only ninety-eight, the lowest on record, and that, though nothing definite has been accomplished in the direction of town planning, the question of arterial roads has been under consideration, and great care is being taken to ensure that the general convenience of the public shall be properly considered in the planning of new building estates. Altogether, Bristol's is a good war record in the municipal sense, and it is certainly one that reflects credit on the city engineer and his energetic if depleted staff.

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Road Maintenance and Economy.

At the present time, when there is a universal demand for the reduction of private expenditure, it behoves all who are entrusted with the administration of public funds to do everything possible in the direction of reasonable economy. By this we mean that, although there is in existing circumstances a plain duty on the part of every public authority to cut down expenses, on the other hand it must be remembered that real economy does not always consist in the immediate saving of small amounts. National economy really means the scientific application of the national resources to the promotion of the national well-being. No doubt the supreme need of the moment is to secure the wherewithal for the successful prosecution of the war; nevertheless there are certain vital public services which cannot be neglected. Chief among these, perhaps, are those which are directly concerned with the maintenance of a high standard of public health, while among those of but little less importance comes the maintenance of the highways of the country. It is not long since a question was asked in the House of Commons as to the possibility of curtailing what the honourable member called the "excessive" main road expenditure of county councils. We cannot, of course, say definitely what this phrase was supposed to signify. If it meant expenditure that is really wasteful and unnecessary, it goes without saying that every possible step should be taken to curtail it. If, on the other hand, as we suspect, it referred to such operations as tar-spraying, or to the continuation of the normal expenditure on road maintenance, the matter is by no means so simple.

In the present issue the surveyor to the Hereford Rural District Council points out in the course of an instructive article that economy in road maintenance with traffic continually increasing is almost an impossibility. We would add that in view of military requirements any lowering of standard is most undesirable. One economy that has been urged is the abandonment of bitumen-bound roads and of tar-spraying work, but inasmuch as a bituminous road, where it is really required, is cheaper than one of water-bound macadam, the possibility of saving in this direction must be regarded with suspicion. Another suggestion is to reduce the expenditure on materials. This again is a dangerous policy, for if persisted in it means bad roads in the future which can only be restored at enormous cost. The only other possible saving of a general character would be in labour, and it might, perhaps, be practicable to do something in this direction. But while the spirit of real economy is to be encouraged, the advisers of local authorities must at the present juncture beware of the wiles of those who deal in the false variety.

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Scavenging by Contract.

Among the duties imposed upon local authorities by sec. 42 of the Public Health Act, 1875, are those of the cleansing and watering of the streets within their district. In most towns this work is now performed by direct labour, but there are still many districts in which the contract system is in vogue. Where this is the case, some difficulty is not infrequently experienced in the proper supervision of the work of the contractor, and in a town of any size proper control can only be secured as a result of a rigidly drawn contract, such as that used by the Philadelphia Bureau of Highways. Philadelphia is one of the few large American cities where practically all the street cleaning work is done by contract, and the extracts from the specification, which appear in a recent issue of our American contemporary the *Engineering News*, are well worthy of perusal by those entrusted with the organisation of similar work in this country. Perhaps the most characteristic requirement is that which relates to the holding of an annual inspection. The specification requires that an annual inspection in the form of a parade shall be held during the year at a time designated by the chief of the Bureau of Highways. The contractor is required to have his entire equipment and employees present, and any equipment or men absent from the inspection, or equipment or men present who do not conform to the requirements of the specifications, are subject to the deductions enumerated in the specifications. On the day of the inspection the men and equipment are relieved of their duties only for the time absolutely necessary, and on the completion of the inspection must continue their work for the full remainder of the day. No fewer than thirty-eight different sums are specified as liquidated damages for various kinds of neglect or failure. The whole specification, which is the fruit of many years' experience, is found to work well for short-term contracts.

Water Undertakings of England and Wales.

THE NEW GOVERNMENT RETURN.

We briefly announced in last week's issue the publication of a Blue-book on the water undertakings of England and Wales. To repeat what we then stated, the return shows the powers, if any, under which, and the limits within which, the supply of water is authorised, the places actually supplied, the sources, nature, efficiency, quantity, and quality; also the area and population and number of houses supplied. In the preliminary memorandum, extending to forty-three pages, it is set forth that the return may be regarded as the first instalment of the detailed and comprehensive investigation of the whole subject of surface and underground water supplies which has been recommended by various Royal Commissions and Committees. The return includes every water undertaking in England and Wales, and is divided into sections—local authorities, joint authorities, companies with specific powers, and private proprietors.

UTILITY OF THE RETURN.

The Joint Select Committee on the Water Supplies Protection Bill in 1910 referred to the apprehension expressed by several witnesses that "the water supply of the country is not being utilised to the best advantage, owing to the want of information on the subject of the general water supply, particularly the subsoil supply; the haphazard and arbitrary fashion in which local sources of supply are sometimes wasted, sometimes withheld from use, and sometimes appropriated for the benefit of other, and often distant, places without regard to the needs of the locality from which the water is taken or of the country as a whole." The committee were struck by the absence of trustworthy, and, indeed, often of any information as to the subsoil water supply available in any particular district, and as to the effect of rainfall on the water levels in various parts of the country. They saw some reason to doubt whether the powers for protecting rivers from pollution possessed by local bodies are effectively exercised by them. They considered that a remedy for this state of things was urgently called for, and they thought that it might be found by creating an organisation empowered to inquire into the whole question of surface and underground water supplies from a comprehensive standpoint; to supervise the future allocation of supplies, and to serve as an authoritative adviser to Parliament in the consideration of particular schemes.

The main facts brought out by the return may be summarised as follows:—

(1) Water is now supplied by a piped service practically to every densely populated place in England and Wales, and most of these supplies are wholesome and adequate. There are still, however, a very large number of rural parishes, some small urban districts, and many outlying houses in larger urban districts, which depend for their water on private sources.

(2) Though some considerable undertakings are still in the hands of companies, the greater part of the population which has a piped service of water is now supplied municipally.

(3) The powers of the general law have not sufficed to give local authorities or companies all the powers necessary for their undertakings. The chief defect in the general law is that it provides no machinery for taking water rights compulsorily.

(4) A great many rural parishes have been put by special Acts into the limits of undertakers who do not supply them, which, in view of the provisions of the Public Health Act, 1875, and sec. 35 of the Waterworks Clauses Act, 1847, may seriously prejudice them in obtaining a supply on terms which they can afford.

(5) In the case of some undertakings large additional quantities of water are available beyond the amounts taken and distributed; in some instances a great deal of the water taken by the works runs to waste.

WATER SUPPLIES FROM DISTANT SOURCES.

It has been seen that many towns now depend for their water on very distant sources. The Manchester supply from Lake Thirlmere is brought 96 miles, the Birmingham supply from the Elan Valley 80 miles, the Liverpool supply from Lake Vyrnwy 66 miles. Leicester, Nottingham, Derby and Sheffield now derive some of their supplies from the head-waters of the Derwent. Bradford obtains water from the Nidd Valley; Birkenhead is constructing a new supply from the river Alwyn. Barnsley, Batley, Cardiff, Tynemouth, and the Fylde Water Board all use sources which belong geographically to other areas.

Water Bills have frequently been opposed in Parliament on the ground that they proposed to appropriate waters which did not belong geographically to the district to be supplied. As long ago as 1865 the House of Commons rejected a Bill on this ground. The provision recommended by the Royal Commission of 1869, and inserted in some Acts, requiring the undertakers of a distant supply to furnish water to districts on the line of the aqueducts, does not fully meet this objection.

The Tendring Hundred Water and Gas Act, 1912, contained a provision, obtained by the Essex County Council, prohibiting the company from supplying water derived from any source in Essex in bulk or otherwise beyond or for use beyond that county without the consent of the county council.

EFFECT OF NEW WORKS ON EXISTING SUPPLIES.

Serious questions in the matter of water supply arise in connection with the utilisation of new sources in proximity to existing sources of water supply. In the case of surface supplies it has been seen that provision is made by Parliament in passing special Acts for compensation water. This principle has not been generally applied to underground supplies, though the effect of sinking a well and using powerful pumping machinery has often been to affect seriously the level of the water in neighbouring wells. The practice of the Court of Referees in Parliament used to be to refuse a *locus standi* to petitioners against a Bill who alleged that they would be injured by the abstraction of underground percolating water. This has now been altered, and a Standing Order empowers the Referees to admit such petitioners to be heard. Since 1899 clauses have been inserted for the protection of existing wells in several Acts authorising pumping schemes.

HOUSES WITHOUT A PIPED SUPPLY.

It is considered that the provisions of the present law for securing a satisfactory supply of water to houses without a supply are not wholly adequate. The power of the inhabitants of a district to compel a proper water supply to be furnished is determined by the provisions of sec. 35 of the Waterworks Clauses Act, 1847, within the limits of an undertaking to which that Act applies. In places not within statutory limits the inhabitants' only remedy is that provided by sec. 299 of the Public Health Act, 1875, which enables them to complain to the Local Government Board that the local authority have made default in providing their district, or a part of it, with a proper supply. In certain cases the Board may make an order, enforceable by writ of mandamus, limiting the time within which the local authority must perform their duty in the matter. Some orders have been made by the Local Government Board under this section requiring local authorities to provide their districts, or part of their districts, with a proper water supply, and, as the board point out in their annual reports, it frequently happens that they are able to secure a remedy in these cases without the issue of an order. The defect in the provision in the Waterworks Clauses Act as a means of obtaining a piped supply of water is referred to in the report, and it is pointed out that the defect of the Public Health Act is that the machinery is cumbrous and can be set in motion only by a local complaint.

In the case of isolated premises it would, it is admitted, be unreasonable to require the local authority to provide a supply of water, and machinery is provided to enable a local authority to compel a supply to be obtained in certain circumstances. A local authority may, under sec. 62 of the Public Health Act, 1875, compel houses within their district without a proper supply to obtain such a supply where it can be furnished at a cost not exceeding the water rate authorised by any local Act in force

in the district, or, where there is no local Act, at a cost not exceeding 2d. a week, or such other cost as the Local Government Board may, on the application of the local authority, determine to be reasonable, and in default of the owner doing the necessary work the local authority may do it. This section, however, apparently applies only where there is a supply which can be brought from the mains of a water company or local authority. The cost referred to in the section is the cost of supply, and does not include the expense of bringing the supply to the premises. It does not, therefore, assist in securing a proper supply for an isolated house, where there is no question of connecting with a company or local authority's main.

Sec. 70 of the Public Health Act, 1875, enables the local authority to apply to a court of summary jurisdiction to close temporarily or permanently a well, tank, cistern, or pump used or likely to be used for drinking purposes so polluted as to be injurious to health. This section, however, gives no power to require a proper supply to be substituted. In London, by sec. 48 of the Public Health (London) Act, 1891, an occupied house without a proper and sufficient supply of water is a nuisance, and, if a dwelling-house, is deemed to be unfit for human habitation. There is no similar provision in the Public Health Act, 1875, and it is not clear whether a house without a proper water supply would come within sec. 91 (i.) as premises in such a state as to be a nuisance or injurious to health. The contract which, by sec. 14 of the Housing, Town Planning, &c., Act, 1909, implies a condition that a house shall be in all respects reasonably fit for human habitation must perhaps be understood to imply that the house is provided with a proper water supply. In rural districts and in the few urban districts to which the power has been given, sec. 3 of the Public Health (Water) Act, 1878, makes it the duty of the authority to see that every occupied dwelling-house in the district has within a reasonable distance an available supply of wholesome water sufficient for the consumption and use for domestic purposes of the inmates of the house. Where there is not such a supply, and the authority are of opinion that such a supply can be obtained at a cost defined by the section (amounting to 2d. a week, or 3d. a week if the Local Government Board so determine) the authority may take proceedings to secure such a supply, and the owner so required to provide a supply may, under sec. 4, appeal to the Local Government Board against the requirement. Action under these sections is comparatively rare.

A further safeguard of a proper supply to houses in rural districts is contained in sec. 6 of the Act of 1878, which provides that houses in rural districts erected or rebuilt after the date of the Act shall not be occupied without a certificate from the sanitary authority that there is provided within a reasonable distance an available supply of wholesome water. A similar provision is contained in sec. 48 of the Public Health (London) Act, 1891, but there is no similar requirement applying to urban districts outside London. Moreover, the maximum penalty for occupying a house without a water certificate is £10 only.

Outside London, therefore, the position is that rural authorities can, under a penalty of £10, require a certificate to be obtained that a proper water supply is available before new or rebuilt houses can be occupied, while urban authorities cannot; that all local authorities can compel a public supply to be taken where a main is available within the limit of cost laid down in sec. 62 of the Act of 1875, and that where there is no main available rural authorities may compel a supply to be furnished for existing houses within the limit of cost laid down in sec. 3 of the Act of 1878. Beyond those limits in rural districts, and where no main is available in urban districts, there is no power under the general law to compel the provision of a supply of water.

PROPOSED LEGISATION.

The following fresh legislation has been suggested on the subject of water supply:—

(1) That Rivers Boards should be established to control the watersheds of the various rivers of England and Wales, the prevention of pollution of their waters, and the management and distribution of the water supplies derived from them, and of the underground supplies of their areas.

(2) That the Local Government Board should be empowered to make Provisional Orders for the compulsory acquisition of water rights.

(3) That in schemes for supplying towns from particular river basins provision should be made for supplies to be furnished to neighbouring villages.

(4) That sec. 52 of the Public Health Act, 1875, should be amended so as to safeguard further the rights of local authorities with regard to parts of their districts placed within the limits of statutory companies and not supplied by them.

(5) That local authorities should be empowered to make by-laws regulating the construction of shallow wells.

(6) That local authorities should be empowered to make by-laws as to the provision of proper water fittings.

(7) That it should be made the duty of the local authority to obtain orders to close polluted wells.

(8) That local authorities should be empowered to provide, or to cause to be provided, a supply of water for a group of houses, and to apportion the expenses as they deem just among the owners having houses within a reasonable distance of the source of supply, with an appeal to the county council or to a court of summary jurisdiction (in place of the provisions in the Public Health (Water) Act, 1878).

(9) That owners should be compelled to lay on water where a pure and wholesome piped supply is provided.

(10) That further power should be given to prevent the occupation of a new house until a proper water supply is provided.

(11) That county councils should be empowered to combine contributory places in different sanitary areas for the joint provision of a supply of water.

HOUSING IN GLASGOW.

AN OVERCROWDED AREA.

The chief sanitary inspector of Glasgow, Mr. Peter Fyfe, in his annual report of the sanitation of the city for 1914, devotes considerable space to the conditions prevailing in the Cowcaddens Ward, which, he says, with its population of about 34,000 upon 158 acres of land, is the most overcrowded ward in the city; 215 persons living upon each acre is quite beyond a reasonable number, and seems to demand some well-thought-out measure, having for its aim a gradual reduction of this congestion. A beginning had been made during the past year upon some of its darker spots, and it was to be hoped that the insanitary dwellings which had been closed under the Housing, Town Planning, &c., Act, and those which still await condemnation and demolition, would not be re-erected, but that the vacant ground would either be allowed meantime to remain vacant, or, if utilised, would contain buildings dedicated to purposes having the cleanliness or the elevation of its citizens in view. Under the Housing, Town Planning, &c., Act, 1909, 600 dwelling-houses were certified as being in a state unfit for human habitation, 128 of these being in the Cowcaddens Ward. There were still a considerable number of very unsatisfactory houses in it awaiting attention, but meantime the lumbering wheels of the law stopped further progress in this direction.

Pollution of Streams.—At the last meeting of the Warwickshire County Council the medical officer of health reported that, pending the completion of the new works at the Warwick outfall works, the town council had allowed the whole of the crude sewage to go into the river, which had been seriously polluted. The county council passed a resolution that a report of the whole matter be made to the Local Government Board with a view to their considering what steps can be taken to increase the powers of county councils to prevent similar pollution of streams.

Primitive Bridges.—Bridges are of ancient origin. Possibly the earliest types were constructed with tree trunks thrown across the stream; at other times large stones were hurled into the river to form piers, on which was constructed a flooring of stones or timber. Several of this latter type, says *Engineering*, appear to have been built in England, and in Devonshire the remains of a stone bridge constructed across the Dart are still to be seen. There are three piers, each composed of six layers of granite slabs above the foundation. The top covering-stones are about 15 ft. long by 6 ft. wide, the whole mass being entirely held together by its own weight.

Points Respecting Reinforced Concrete for Roads, Sewerage, &c.*

By ARTHUR E. COLLINS, M.INST.C.E., City Engineer of Norwich.

The ease with which the best shapes for any particular construction can be obtained in reinforced concrete has always made it a fascinating material to engineering and architectural designers. Its durability has been proved in many ways, including the life of reinforced-concrete houses built in Newcastle-on-Tyne half a century or more since. When the brick walls of the sea lock at Lowestoft were pulled down some years since, the writer saw hoop-iron reinforcing taken out quite free from rust. It had been in position between high and low water for half a century or more; its condition was due to the protecting influence of mortar. All the reinforcing iron found was in equally good state. That reinforced concrete is reliable is shown by the large number of bridges, reservoirs, piers, wharves, sewers and buildings of all sorts constructed of it, and giving good service. Where failures have occurred good reasons have been found, and these failures have not indicated properly designed and made reinforced concrete to be an improper material for use under a wide variety of conditions.

In the early days of reinforced concrete too much reliance was placed on the surface adhesion of concrete to steel, and neither sufficient knowledge nor care was exhibited in properly disposing the reinforcement, nor in making and using the concrete. Accumulating experience has largely remedied this, and to-day good methods are well known and generally applied; but it depends on the responsible engineers of works to ensure that they are applied.

The average municipal engineer has neither the time nor the staff to make the voluminous calculations necessary to design in this material, and must be satisfied by the use of tables after carefully checking them. The "Manual of Reinforced Concrete," by Marsh and Dunn (Constable & Co., 10 Orange-street, Leicester-square, W.C.), is of great use to one engaged in designing. The "Graphical Handbook for Reinforced-concrete Design," by J. Hawksworth (published by Crosby Lockwood), has proved most useful in the writer's office.

Anyone using these tables should note that the best British practice allows of somewhat higher values for concrete in compression than the constants in Hawksworth. Hawksworth refers to the New York Building Law, wherein the maximum allowable compression in concrete is 500 lb. on the square inch, whereas the Draft of Regulations of the London County Council for Reinforced Concrete of April, 1915, proposes the following:—

Proportion by Volume.

Stress in concrete	Cement.	Sand.	Coarse material.	Cement.	Sand.	Coarse material.	Cement.	Sand.	Coarse material.	Cement.	Sand.	Coarse material.
	1	2	4	1·2	2	4	1·5	2	4	2	2	4
	Pounds per square inch.			Pounds per square inch.			Pounds per square inch.			Pounds per square inch.		
Direct compressive stress	600			650			700			750		
Extreme flexural compressive stress in beams.	680			650			700			750		
Shearing stress	60			65			70			75		
Grip or adhesion between concrete and steel bars, hooked at both ends.	100			100			100			100		
Grip or adhesion between concrete and steel bars, otherwise effectively anchored at the ends.	60			60			60			60		
Tensile stress	Nil			Nil			Nil			Nil		

Increased compressive stress is permissible in the core of a pillar suitably hooped.

Anyone likely to require to design work in reinforced concrete should study the London County Council Draft of Regulations to be made under the provisions of sec. 23 of the London County Council Act, 1909, with respect to reinforced concrete, dated County Hall, Spring-gardens, April, 1915. It embodies much of the work of the Joint Committee of the Royal Institute of British Architects, Institution of Municipal and County Engineers, District Surveyors' Association, Institute of Builders, War Office, Admiralty, London County Council, and Concrete Institute, and gives, in a much more concise form than the writer is capable of, a very complete set of working rules for reinforced-concrete design and construction, and excepting for suggestions on a few points no further reference will be made to rules.

Where the reinforcement bars are not sufficiently long, the writer prefers to joint them by hooking, tieing the hook and making quite sure the bars are drawn very tightly together before concreting. If this precaution be omitted serious results may obtain. It is obvious if any space improperly left between the hooks be filled with concrete its strength is quite inadequate to prevent the hooks drawing more or less together when the reinforcement is thoroughly stressed.

The writer was much concerned when he drove his first reinforced-concrete piles, several years since, by the extensive shattering of their tops, and by the difficulty of making them penetrate the layer of faggots carrying the railway bank he was operating in across a marsh. The piles had been made several months, but had little strength. On considering the matter it was remembered there had been a month of severe frost, followed by cold weather, commencing shortly after the piles were cast, hindering the setting. The period allowed for setting was increased by the duration of frost, but allowance was omitted for the slow thawing during the cold period following the frost.

The remainder of the piles were not driven until thoroughly set, and no further trouble arose.

About fifteen years since the writer constructed reinforced-concrete floors in a large building he was then erecting. To obtain lightness he used furnace clinkers largely in his aggregate. His equanimity was much upset by the forward movement of the whole front wall of the building, four storeys high, upon the asphalt dampcourse, which investigation showed to be due to the presence of sulphur in the clinkers, resulting in expansion of cement in the concrete floors. The movement amounted to less than ¼ in., and did not continue, nor have the floors given trouble; but furnace clinkers have not been used since.

When constructing reinforced concrete, see to it that all reinforcement is properly placed, supported, and not displaced by the concreting operations. If this be not done, disaster may easily result.

Mr. R. S. Greenman, in a paper on "Causes of Concrete Failures," presented to the American Society for Testing Materials, states "that reasons for poor concrete have been proportioned as being 90 per cent due to poor workmanship, 8 per cent due to poor aggregates, and 2 per cent to poor cement. The percentages are not due to tabulations, but are those prevailing in the minds of many who have had considerable opportunity for inspection of concrete, both good and bad." Without expressing an opinion upon these percentages, it is obvious, seeing most engineers test their cement, that the use of bad cement is not likely to be a cause of failure; again, engineers are usually able to ascertain the quality of aggregates

* Paper submitted at the recent annual meeting of the Institution of Municipal and County Engineers.

before use. How many of us, however, have the opportunity to completely check the labour on our works? To say the least, it is probable Mr. Greenman's percentages are not far from actuality.

Care must be exercised all around. For instance, water flowing from woodlands containing vegetable extractives has a prejudicial effect on cement. Aggregates, such as destructor clinker, containing free lime are injurious. In his own work the writer has had concrete walls, pavements, steps, and other constructions injured thereby. Clinker, coke breeze, and other aggregates containing sulphur, must always be avoided; they are destructive of cement. Some shale bricks contain sulphur, and old bricks of this variety are unsuitable for concrete aggregate. The writer is aware of great difficulties which arose with the brick walls of an important reservoir built with shale bricks, also with the walls of a sprinkler filter installation. The cement in the mortar became quite changed. In one case it had the appearance of unset chalk lime paste after a life of a year, although when first built the cement mortar set well.

Probably the best material for the aggregate of engineering reinforced concrete is broken Portland stone. This should be used without screening, but care must be taken to remix the various sizes if they sort themselves in transit. Mr. J. P. Wells, an acknowledged expert on reinforced concrete, thinks very highly of this aggregate. Its specific gravity is not high; it breaks with a roughly fractured surface, and there appears to be an affinity between it and cement, with the result that where concrete made with it is crushed the fractures do not generally follow the surfaces of the individual stones; whereas, in the case of river ballast, and of many varieties of stones, this cannot be said.

The earliest use of reinforced concrete in road foundations known to the writer was by the president when engaged in road improvements in advance of tramway construction for the Middlesex County Council. In one of these roads the writer visited with him the regrading necessitated a considerable depth of clay fill; to avoid the worst consequences of settlements he covered this with a reinforced-concrete raft. Upon recent inquiry the writer ascertained this had been successful. The reinforcement did not consist of fencing wire, which is now advertised as sufficient, but of moderately heavy round bars—probably ⅜ in. diameter—laid about 1 ft. apart each way, embedded in the concrete.

The writer has had no experience with the use of the meshed wires similar to fencing wire now sold for concrete road-bed reinforcement, and hopes some member who has used it will give the benefit of his experience.

Reinforced concrete is particularly adaptable for pile construction, whether they are cast before driving or the mould is prepared in the ground by driving a shell, the reinforcement inserted, and the pile cast in situ, withdrawing the shell simultaneously with the casting. Large numbers of piles cast in situ are not reinforced. Probably the best known in this country of the in situ piles are the Simplex piles.

For interesting detailed descriptions and illustrations of reinforced-concrete piling, see Mr. A. R. Galbraith's paper on p. 356 of vol. xxxi. of the "Proceedings."

Reinforced concrete is a most adaptable and suitable material for constructing manholes, underground chambers, &c., in unstable or water-bearing ground. The structures can be moulded in the dry and sunk to the required depths, necessitating the minimum of timbering and pumping.

About twenty years since the writer sunk a large double screening chamber to many feet below water level in very bad, freely permeable ground. The work was quite successful in construction, and has cost nothing to maintain.

For retaining and abutment walls reinforced concrete is especially suitable, particularly where great width of foundation and weight are wanted, as in many dock walls. The walls can be constructed with flat plate or deck foundations, of any desired extension, vertical flanges, buttresses or revetments, and weighting shelves moulded at the back of the wall, so that the whole construction is monolithic. The soil removed in preparing the foundation can be filled in on the plate or deck foundation, and upon the weighting shelves at the back of the wall to provide the necessary weight.

A most interesting and economical design on the Hennebique system appears on pages 374-5 of vol. xxxi., 1904-5, of the "Proceedings," where the expense of laying the foundation plate or deck at the level of the foot of wall is avoided, and a very good use of reinforced-concrete piles is introduced to support the deck at a relatively high level. This wall was estimated to cost one-half that of an ordinary gravity dock wall.

Some drawings of executed reinforced-concrete bridges are placed before you, but it is not proposed to lengthen this introductory paper by detailed descriptions of the work.

(1) Working drawings of Dolphin Bridge, Norwich, across the river Wensum; designed by the author and built by administration under him in 1908. In the attempt to get a pleasing surface to the visible faces of this bridge, the author used a mixture of cement with mica and quartz sand and fine gravel obtained from china clay works for a thickness of about 1 in., and scrubbed the surface immediately he could remove the moulds. The spandrils were cast against embossed sheet steel plates to obtain the decoration in slight relief. These plates were supplied by the British Stamped Metal Ceiling Company, Limited, 97 Queen Victoria-street, E.C.

(2) Coppermill Bridge, between Staines and Windsor, across the river Colne; designed and built by D. G. Somerville & Co., Limited, 120 Victoria-street, S.W., in 1914. The cost was about 15s. per foot super. of bridge proper—*i.e.*, excluding wing walls. The aggregate was dredged at the site. The reinforcement is all of ordinary round bars. The designers have lent me the calculations for this bridge for your information.

(3) Culverley Bridge, 15 ft. span. This bridge was built by the Trussed Concrete Steel Company, Limited, Caxton House, S.W., for the New Forest District Council, using Kahn system reinforcing bars. It was erected in 1914.

(4) Bridge at Prescott; seven spans 11 ft. to 27 ft.; designed by Mr. H. Kempton Dyson, Denison House, S.W.; built in 1914, using Kahn system reinforcing bars.

The object of exhibiting these working drawings is to show those who have not yet had to do this sort of work how some other people have carried it out.

The writer has used reinforced concrete largely in sewer construction, and with great economy. The 36-in. pumping rising main at Norwich was constructed in this material some ten years since on the "Bonna" system. It has been entirely successful in all respects. The pipe cost about one-half that of a cast-iron pipe and three-quarters that of a steel pipe. It has cost nothing in maintenance, and appears as good as new. A description of this pipe may be seen in the author's paper, page 185, vol. xxxiv., 1907-8, of the "Proceedings." The pipes were made by the Columbian Fireproofing Company; the present makers are Messrs. Hughes & Lancaster, 16 Victoria-street, S.W.

There are considerable lengths of reinforced-concrete gravitating sewage and surface water sewers in Norwich from 42 in. diameter down to 21 in. Some have been laid a quarter of a century. All have been entirely satisfactory; no repairs have been done to any of them, and they are as good as when laid.

A cheap and convenient combination of concrete with steel can be used for the construction of culverts as follows:—

Prepare a suitable concrete bed, finishing to about 1 in. below invert level, on this bone in concrete supports, say 3 in. by 3 in., by about 1 in. high, to the desired gradient and height to support sheet iron or steel slip-jointed pipes; cover the pipes with concrete to the desired thickness. Using suitable concrete, the construction may be buried the day after construction. Eventually the sheet metal will rust away, leaving a concrete interior surface to the culvert. If it be desired to avoid this, insert a spiral of, say, $\frac{3}{16}$-in. or ¼-in. wire to fit sheet metal pipe, the pitch of spiral being, say, 9 in., place a collapsible mould 2 in. smaller than the pipe concentrically within it, and run the annular space full of fine concrete. This is, of course, done before the pipes are laid. Allow for the lap of the slip joints when casting the interior concrete.

The writer has used such construction (omitting the concrete lining) successfully and economically in a trench from which the tide could not at all times be excluded.

Pudlo.—In an hotel situated in a very exposed position in Surrey (at a height of 1,000 ft. above the sea level) it was decided to rough-cast in Portland cement and Pudlo. We understand that the architects are very pleased indeed with the weather-proofing results.

The Reconstruction of Roads in Belgium.*

By HENRI VANDERVIN, Ingénieur en chef Directeur des Ponts et Chaussées de Belgique.

The Belgian road system is very extensive—perhaps the most extensive in the world in proportion to the area. It covers more than 10,000 kilometres (6,214 miles) of principal roads (routes de grande communication) in addition to a considerable length of "vicinal" roads—that is to say, roads which have not the character of large thoroughfares traversing the whole country, or an important part of it. These vicinal roads are established and maintained by the communes with the financial assistance of the Government (State and Provinces), whose subsidies grow constantly more considerable, thus affording eloquent testimony to the part taken by the higher authorities in the improvement of this system. I shall only deal here with the great thoroughfares (chemins de grande communication) corresponding to the main roads of the United Kingdom. Their length attained 3,241 kilometres in 1830, on the establishment of the Monarchy. In 1911 it amounted to 9,787 kilometres. The improvement has therefore been one of considerable extent, and its development for a small country whose territory covers an area of 2,945,104 hectares (7,277,352 acres) is remarkable, as will be generally agreed. These main roads are divided into two classes, the most important extending to 8,192 kilometres; but the condition of this large network of roads in an important part of the country left a great deal to be desired.

Many of our roads still leave much to be desired, in spite of the enormous expenses which have been incurred since the revival of road traffic; many will have been seriously damaged by military traffic and strategic operations. It will be necessary to reconstruct them to a considerable extent, in order to ensure to Belgium that fresh start which her activity must undertake on emerging from her present sufferings. It will be necessary to avoid the infatuation for a uniform system, to adapt to each case the kind and type most suitable; but everywhere the work must be carried out with the proper materials and care of execution in order to obtain surfaces which are smooth, and all of a width which will allow the passing of vehicles and prevent the traffic from following a single track. It will be necessary to adopt a moderate camber, to abolish it altogether at curves, and to replace it by a transversal inclination, to widen the metalling at these points, to rectify the alignment, to provide good foundations, and to make the surface such that the formation of a quantity of dust will be prevented.

The expense will be enormous, but it will be remunerative in view of the development of traffic upon the roads which has already taken place, and which, there is no doubt, will, in the future, show a still greater increase.

But it is not only the reconstruction of the metalled roads in certain points to which our attention should be directed. The pedestrian does not, as a rule, enjoy the facility and comfort on our country roads to which he has a right. The flood of traffic which must go on over our roads should be able to flow with ease in all its diverse forms.

THE ENGLISH MODEL.

Those who in these terrible times have been sojourning in this hospitable country of England will carry away with them a vivid impression of the advantages and charm of domestic life outside those large centres where the business of the day is carried on. Many will go back with the desire and intention of establishing their homes also outside the towns. But in order that life in the country may be carried on with all the comfort which is assured to it in the United Kingdom, it is particularly important that a country road should be as convenient to traverse as the streets of a town.

In England the pedestrian has usually by the side of the road his own path, which is inviolable. On most of the main roads he finds a sidewalk which is reserved for him, upon which he can stroll in peace without fear of motor car, motor cycle or bicycle, and this sidewalk is often covered very economically with a layer of gravel—sometimes, at the edge of the road, with a light tar-macadam, sometimes even without any kerb. Thus the sidewalk easily gets rid of the water, is firm under foot, clean, easily maintained and convenient for walking.

In Belgium—we may as well admit it—the sidewalk, when it exists, has usually been constructed for the benefit of cyclists, and sometimes the motor cycle itself has been admitted on it. The pedestrian, if he ventures upon it, is the prey of a perpetual fear of destruction, and at every moment has to step out of the way to allow a machine to pass him.

Why should not that which is carried out in England be possible with us? We possess country roads which are, as a rule, wider than those in England. From this splendid width we do not derive all the advantage that we might by regulating the traffic of vehicles and pedestrians. The roadsides outside the metalling are almost unused, or at least used only for a cycle track. It should be simple to find in them all that is necessary for the purpose of excellent sidewalks. In cases where the width of the road is not great, the system often adopted in England—which consists in covering the road with metalling over its whole width, with the exception of a sidewalk on one side only—seems to me to present great advantages. The bicycle must, of course, run on the metalling, which has a surface so smooth that the cyclists have no ground for complaint.

Undoubtedly the drainage of water requires precautions and certain engineering provisions; but when these have been well though simply established this can be thoroughly ensured, and on such lines that the watering of the metalling, which is so essential to its good preservation, can be in this way even better effected than when this metalling is bordered only by earth sidewalks which retard the water and through which it filters. *Experiencia magistra!* The ruling formula of the engineer here again exemplifies its truth by the example of the good roads in England.

ROADSIDE TREES.

On the other hand, our roads possess one notable point of superiority in that beautiful adornment which is afforded by the rows of trees which cover, as with an arch, a portion of the roadway, giving welcome shade in the heat of summer, while in the rainy season they lose their leaves and allow the air to sweep freely over the road. And what an adornment it is, giving as one travels over some beautiful road the impression of passing along a broad avenue of some great private domain. Let us carefully, jealously, preserve our plantations of trees.

At the same time, it is a question whether the position of the trees on the ridges of the roadsides is always the best. To the frontager who complains the natural reply is that he must be expected to put up with a certain amount of nuisance in view of the many advantages which the road brings him. If, however, the nuisance can be avoided, why should one not avoid it? And when a building is erected on the frontager's land and suffers from damp owing to the trees, it becomes necessary to sacrifice the tree, an element of general well-being, to prevent undue injury to an individual interest. On the main roads where they traverse urban areas, even in the villages, it becomes the rule to do away with trees and the exception to preserve them.

The position of the tree on the edge of the road when the latter is broad is due to the primary idea which leaves to the traffic of vehicles the entire breadth of the road, whether metalled or unmetalled, and if the sides can be done away with, or, at any rate, converted into side-walks, the tree might be placed at a distance from the ridge. In this way it is often possible to carry out a very satisfactory alteration.

What, then, is the best course to adopt? Again, let us avoid any rigid rule, any general and absolute regulation. By this means the requirements both of the seeker after the beautiful and of the utilitarian may be satisfied. Let each case be examined and decided upon by taking note of the surrounding circumstances. The traffic is not the same everywhere; its intensity and its character vary. Soils are of many kinds, localities are different, the atmosphere varies, and so also do the longitudinal and cross sections. On the same road the position of the trees should often be modified, according to the situation. The danger that at certain points the position of

* From a paper read at the recent National Road Conference in London

the trees might form an obstacle to the motorist's view must also be taken into consideration. An absolute rule therefore would be irrational.

Moreover, the tree is a charming friend, but one whose friendship is not fully acquired until many years have passed. In England it is perhaps more fully appreciated than anywhere else; it is respected, it is protected, it is given its independence, it is not mutilated. The beauty of its natural form is more respected in that it is not lopped to an exaggerated height, nor is it allowed to be so absurdly shaped as to bear the appearance of a balloon perched on the top of a bare pole. Everywhere this policy finds a rich reward.

If we have beautiful trees, let us spare them as far as possible (in that, indeed, the Government is concerning itself) even if they happen to be in unfortunate situations. In such places let us plant the new ones with better judgment.

Considerations of the same kind should preserve us from too monotonous alignments, in accordance with which buildings stretch in uninterrupted lines from one end to another of the road. If we were to continue to pursue this course our urban main roads would soon be quite insipid, dull and vulgar. Farewell to the picturesqueness which is caused by variety and the unexpected, nowhere a projection which strikes one's eye in the monotonous vista. "Boredom was one day born of uniformity."

AIR AND LIGHT.

The Belgian Government has already required that along many of the new roads there shall be a definite space between the road and the building line. We must, it seems, proceed with determination upon this course in order to ensure to our roads, at any rate outside the large centres, air and light, and the adornment of gardens at their sides. Comparatively narrow roads can in this way be transformed to some extent into broad thoroughfares. Those who have lived in England will carry away with them in this respect a very strong impression in the picture of modern thoroughfares, broad and pleasing in spite of the actual roadway being often of quite a moderate width.

What a lesson, too, do the English teach us in the matter of their fences, so often consisting of beautiful hedges, wide and thick, whose green defies even the sadness of the winter. This allows those on both sides of the hedge to profit by the air and light of the neighbouring garden, or of the road, as the case may be, whereas our gardens are shut in by walls, which form airtight partitions, preventing the air from ventilating the confined atmosphere, filling with sadness all the little cell-like courtyards, and forming a lifeless screen the whole length of the road.

OUT OF EVIL . . .

Many of our highways will have suffered much, some are absolutely in ruins. In reconstructing them it is by some such considerations as these, I think, that we should be inspired. Out of evil must arise good. The destruction must be made the opportunity of a reconstruction in a modern spirit, with attention paid to life, comfort and cheerfulness.

The ruin of many buildings is an opportunity which should be seized for a modification in this direction. In some instances it will no doubt be desirable to consider whether the operations should not be even more radical, whether instead of a local improvement it would not be better to effect a complete diversion of the road and to reconstruct it entirely in a modern spirit.

Those critical points in the Belgian road system formed by bridges, where the interests of the roadway and the waterway are in conflict, will undoubtedly in many cases need very special consideration. The destruction of these works will have been very general, the adjoining lands will often have suffered also, and their ruin will form an excuse for considering, for the approaches, solutions hitherto too costly, such as the establishment of a fixed bridge at such a level as would render the water and road traffic independent of one another. On the same grounds it will be proper to consider whether, in the case of a previously existing site which was unsatisfactory, it would not be well to substitute a better.

In certain thoroughfares the carriageway leaves much to be desired, its alignment needs to be improved, its sections require to be increased and rectified, but the expenditure which such work would entail on an area covered by buildings has caused its postponement. Now, however, it might be undertaken with greater liberty, and a plan might be laid down from this point of view. There must be in the first place some broad lines of lay-out recognised, with which the plan of the town will coincide.

In this connection it should never be forgotten how much life and cheerfulness is given to a city by a stream of water running through it, when the water is clear. If necessary, measures must be taken and resolutely carried out in order to prevent its pollution. A river is a national possession which individuals have no right to poison. If the course of a stream is diverted, it should be considered whether its former bed might not be utilised for the formation of pieces of water round which public gardens might be grouped.

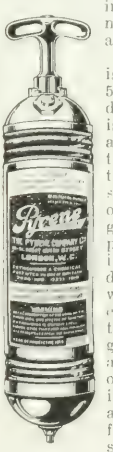
Again, in many places, alas! the devastation has been such as to create open spaces where once were buildings. If these come in the track of a road they should be respected, if possible, and made use of, so as to afford to the locality more air, light and verdure —the triple formula which constitutes the town planning gospel. That great administrative authority which governs the road might well in this way set an example which the local authorities might follow.

These, then, are a few general considerations which I think may properly be put on record at the present moment with regard to that great work of reparation, the remaking of our roads, which the morrow will impose upon us. They are written only from a personal point of view with the object of arousing criticism. The problem is a vast one, and its realisation costly. There are many points which will have to be looked to and which cannot be dealt with in this short memorandum. It is the duty of each individual to ponder over the question and to submit his reflections for general criticism, for the advantage of our reconquered country, whose gaping wounds must be healed, whose glorious future, assured to us by a heroic pride and determination, is already shining on the horizon.

THE "PYRENE" FIRE EXTINGUISHER.

The Pyrene Company, Limited, 19-21 Great Queen-street, W.C., inform us that the London County Council have just placed an order for the "Pyrene" fire extinguisher to be installed in all their special dwellings throughout the Metropolis.

The island-site in Aldwych, London, was the scene recently of a demonstration in the course of which this apparatus was submitted to a series of tests which supplied ample and convincing proof of its efficiency. A variety of highly inflammable materials were used for the purposes of the tests, but in every instance the blaze, whatever its fierceness, was overcome in a very few seconds after the application of the Pyrene.



A point in favour of the extinguisher is its lightness — it weighs only 5½ lb. In length it is 14 in., and its diameter is 3 in., the container, which is of 1 quart capacity, being fitted with a double-acting hand pump capable of throwing a continuous stream to a distance of about 20 ft. The liquid is described as a combination of purely organic character, with a high specific gravity, and when subjected to a temperature of 200 deg. Fahr. or over is immediately transformed into a heavy, dry, cohering, non-poisonous gas blanket which surrounds the burning material, cutting off the air supply necessary for the life of the fire, and thereby extinguishing it. It does not deteriorate with age, and will not freeze at a temperature of 60 deg. Fahr. below zero. Therefore it does not require inspection, and is always ready for instant use, while the fact that it does not contain acid, alkali, salts or moisture enables it to be used with the knowledge that the liquid will not damage machinery, fabrics, or anything else with which it may come in contact.

After severe tests the War Office and Admiralty have ordered over 37,000 Pyrene extinguishers for various purposes, and other evidence of its efficiency is supplied by the company's statement that it has been adopted by municipal authorities, fire brigades, and colliery, railway and steamship companies. Further, it is installed in many of the largest factories and warehouses in Great Britain.

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING IN LONDON—(8).

A paper entitled

POINTS RESPECTING REINFORCED CONCRETE FOR ROADS, SEWERAGE, &c.

reproduced elsewhere in this issue was presented at the annual meeting of the Institution of Municipal and County Engineers by Mr. A. E. Collins, M.INST.C.E., the city engineer of Norwich.

Mr. W. Matthews Jones (Chester) said he could find in the paper no mention of the reinforced-concrete roads laid at Norwich. Mr. Collins went in chiefly for piling, and that class of work, but he (the speaker) had laid reinforced-concrete roads with very good results up to the present. He did not think reinforced-concrete roads had been so thoroughly tested for anybody to give actual results as to how long they were likely to last, but in America they were constructed on a very large scale, and he felt sure reinforced-concrete roads would come to stay in this country. They were easily and cheaply constructed with the best results. He had one piece of concrete road laid five years ago, but it was not reinforced, and his experience of that led him to think that reinforcement was necessary. The concrete started to get wavy owing to the clay subsoil on which it was constructed, and he then tackled the question of reinforcement. One road which had been laid for two and a-half years was in very good condition, and no waves or marks could be seen in the surface, which was tar-sprayed and covered with granite chippings. The reason for that was that, having the road open for three months before tar-spraying, he noticed that the cement was being crushed and forming dust on the road. He might read a paragraph from the Eighth Annual Report of the Board of County Road Commissioners of Wayne County to the Board of Supervisors of Wayne County: "The fact that we have over 100 miles of concrete road in Wayne County, some of it in its sixth year of service, without the semblance of a rut, without a single 20-ft. section having been taken up and replaced since we have been building and developing this type of road, is ample justification, in our opinion, for the adoption of the concrete road as our standard type of construction. It is comparatively low in first cost, it furnishes good traction for all types of vehicles, it is not slippery, it is durable, it does not require expensive yearly maintenance charges, and it is usable 365 days in the year irrespective of weather conditions. We feel a pardonable pride in calling your attention to its general adoption, not only in this locality, but throughout the entire country." He thought that if engineers and surveyors in England would take the trouble to get reports from America they would feel amply justified in laying reinforced-concrete roads in this country. [The President (Mr. H. T. Wakelam): What is the tonnage per day on the roads you built in that way, the thickness, and the cost per yard?] He was not yet prepared to divulge the tonnage, but the thickness of the concrete was 6 in., laid on a clay bank. The road led to the Birmingham Wagon Works and two large brickworks, and there had been extensive building operations on one side of it, all the traffic in connection with which had passed over the road. The actual cost was 3s. 10d. per yard super., including the reinforcement, whereas a macadam road adjoining cost them 6s. 10d. per yard. They used British steel reinforcement, No. 8 gauge, and they mixed their concrete in the proportion of 6 to 1. The granite was obtained from Chirk. The sand, which was very coarse, was obtained from close to Chester.

Mr. A. J. Lyddon (Essex) said they had had a little experience with concrete for foundations, and where the foundation had been for a wood-block pavement at the point where the wood paving ended a considerable amount of springiness was observed, to such an extent that where other sections were laid they found it necessary to increase the thickness at the end of the section to 18 in. to give the effect of a beam at that point. Another section they laid in the Romford-road with 4 in., 5 in. and 6 in. of concrete, each with a No. 9 reinforcement, and on each they laid 4 in. of Tarmac. That had been down for two years, and there had been no difference in the surface at all. About three months ago a section was cut out, and it was found that where the reinforcement was laid 1½ in. above the lower layer there was no distinction between the upper and lower layers of concrete.

Mr. W. J. Hadfield (Sheffield) asked whether anyone present could tell them anything about the experiment of the Kent County Council at Gravesend.

Mr. C. F. Gettings (Worcestershire) said he had an opportunity of inspecting the section at Gravesend, the whole length of which had just been completed. Unfortunately for the Kent County Council, they had a good deal of military traffic on the road, and that had to be put over the new part of the road while the other half was constructed. Most of them who had had experience of that material could imagine what happened. Those who had had an opportunity of inspecting this section would agree that it would have been desirable to have put some form of bituminous material on the first half before commencing operations on the second half. He was rather interested in the remarks of Mr. Jones with regard to the reinforced-concrete road at Chester, the cost of which he had given as 3s. 10d. per yard. He (the speaker) had put down a considerable quantity of reinforced concrete—not for a road, but for other purposes—and was at a loss to understand how Mr. Jones could put down his reinforced road at 3s. 10d. per yard. He would also like to know the tonnage of the traffic over the road, which, from what he knew of the Chester district, he could not imagine would be very heavy. The price of 6s. 10d. for an ordinary macadam road seemed somewhat excessive. He supposed Mr. Jones was very well situate for getting ballast material, and he should have thought he could have constructed an ordinary macadam road for 4s. a yard.

Mr. L. Roseveare (South Shields) stated that his trouble in pile-driving had not been with the shattering of the tops of the piles, but with hair cracks between high and low water mark. He was going in for a quay extension, but having seen some of the results between high and low water mark, where water got in at one time and air at another, it made one very diffident about going in for what would otherwise be a cheap form of construction. He would like to ask the author whether he had ever cut through one of the large 42-in. sewers to see what the effect on the steelwork, if any, had been.

Mr. Collins, in replying, said he was rather afraid the title of his paper was scarcely as explanatory as it should be. It read as if he were going to deal with reinforced concrete for roads; he should have said for roadwork, bridges, retaining walls, and so on. But he was very glad it had had the result of attracting remarks from Mr. Jones and other gentlemen as to reinforced concrete for roads. That was a subject he wanted to get some information about. The trials which had been made at Chester with reinforced concrete were very valuable, and he hoped they would hear more of them. Some twenty-three or twenty-four years ago he laid a concrete macadam road; that stood very well for ordinary traffic, but as soon as heavy traffic came on the road began to break up. That was his experience with concrete roads. One of the principal objects he had in preparing a paper was to get together a few particulars of works as a reference to help people who were engaged in reinforced-concrete designing. He did not attempt to go in for minute descriptions of works. He had taken a lot of trouble to get a decent appearance on the concrete, and he thought he had been fairly successful in that. He generally finished the surface with quartz sand.

(To be continued.)

Insurance of Municipal Property.—At Monday's meeting of Scarborough Town Council the chairman of the Finance Committee said the corporation had insured all the corporation buildings against aircraft and bombardment under the Government scheme, and, where necessary, against loss of rent as well. They had also insured the waterworks and Valley Bridge. This practically covered the whole of the property belonging to the town. The total cost to the borough was £483.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐδεὶς ἀνὴρ πάντα
(*One man does not see everything*)
EURIPIDES.

CLASSIFICATION OF BITUMENS.

To the Editor of THE SURVEYOR.

SIR,—Mr. Darrel T. Pierce, of the Barber Asphalt Paving Company, in his letter you publish in your issue of July 16th, refers to remarks you have previously published of mine on the subject of petroleum pitch and natural bitumen, and it is obvious, I think, as Mr. Pierce says, that by describing petroleum pitch as bitumen, and giving it this higher sounding title, more money or profit can be obtained.

You have kindly allowed me to state on several occasions in your columns what I know to have been the classifications of various bitumens and asphalts for the past thirty years, and it was not until bitumen was found to be so suitable for road work that the loose handling of this word came about. Petroleum pitch has always been known as such until recent years, when it has been said to be "pure bitumen" containing 99 per cent or more bitumen.

There is no deposit that I know of of chemically pure natural bitumen containing 99 per cent or more bitumen anywhere in existence, and the very fact, therefore, of describing a product as "pure" in the chemical sense, in my opinion proves that it is artificial, and not a naturally produced material.

As far back as August 30, 1912, I suggested in your paper a very simple way in which any kind of bitumen could be distinguished by engineers or those unable to recognise it by appearance. All the bitumen deposits in the world are known, and as the characteristics, properties and analyses of the various bitumens differ one from the other, these could quite easily be tabulated and published, so that if any one bitumen was offered at any time it could, by applying a few simple tests, be ascertained from what particular deposit or country it came.

Petroleum residuum could also be distinguished in this way, as the analysis of this differs from any natural bitumen in existence.

Further, there is no single quality possessed by the residuum of oil distillation—*i.e.*, petroleum pitch—except, perhaps, the smell, that is not contained in coal-tar pitch when tempered with oil to the same degree of consistency, and yet engineers are asked to pay, and are paying, for petroleum pitch four times the cost of coal-tar pitch. Mr. Pierce has given you the reason for this, and he also very correctly adds that these residual pitches are not entitled to the flattering name of bitumen.

As I mentioned in my letter you published in your issue of May 20th, I am strongly of the opinion that there is every evidence to prove that the term bitumen has always been understood to refer to a natural product, and the law, in my opinion, would uphold what has been the custom and practice of the trade for many years past.

There are other pitches, as you will be aware, in addition to petroleum pitch, and if any one pitch is entitled to the term bitumen then the same must apply to all others, and if it is right to supply a buyer with petroleum pitch when he asks for bitumen, then it is equally right to supply him with coal-tar pitch or any other kind of pitch.

It is not possible now to go into the merits of the various products concerned, but for road construction, or any other work in which these materials are employed, natural bitumen is as much superior to pitch as leather is to brown paper for the manufacture of boots.

When the properties of natural bitumen are known, and questions such as durability, length of life, effect of cold, heat and wet, resiliency, softening and melting points, &c., are taken into consideration, I venture to say from experience that natural bitumen will, in course of time, displace pitch and all artificial and perishable products.—Yours, &c.,

A. E. H. DUSSEK.

London, E.
July 21, 1915.

ROAD TARRING.

To the Editor of THE SURVEYOR.

SIR,—As tar-dressing is now carried out by almost every highway authority in the kingdom, I think your suggestion in last week's issue, that it would be well to have some official pronouncement as to what is the best method of applying tar to the surface of our roads, is an excellent one, and if surveyors will state their experiences of various methods it will tend to promote efficiency of application with economy of working.

After an experience of mechanical-pressure machines, I have come to the conclusion that I can apply the material in correct proportions, and more economically and efficiently, by means of a distributor of my own construction—a can with a capacity of 2 gallons, with a tap in the bottom, which lets the material through on to a cone, distributing it in an even film 18 in. wide. This I have used in conjunction with an ordinary tar-boiler, and can apply the material at practically boiling-point. The man using the distributor is immediately followed by another man with a 2-ft. double reversible squeegee, set at an angle of 52 deg., and before the material loses its heat, by means of the squeegee, all the surplus is pushed on to the untarred portion of the road.

I can tell exactly what yardage I obtain from each bucketful of material, and find that I generally cover 7 yds. to the gallon, and have covered as much as 1,200 super. yds. per hour.

I have recently completed the tar-painting of 37,652 super. yds. for my council at a cost of 1·34d. per super. yard, which includes sweeping and gritting.

My method keeps all the workmen clear of the tarred portion, and there is no risk of the material blowing on to pedestrians or vehicles.

In my opinion much of the success of tar-painting depends upon applying tar at the proper heat, and by my method I put on 2 gallons in twenty seconds, covering 14 yds. with that quantity. To get the best results the material should be applied at practically boiling-point. Judgment should be exercised in sweeping the road. All loose dust should, of course, be removed; also all dust from the surface of the macadam; but hard sweeping-out of the interstices by means of a horse broom adds unnecessarily to the roughness of the surface of the road. From my experience I find that a final sweep with Archer's soft brooms is the best guarantee of a good surface for tar-painting.

When applying the material, to flood the interstices is a waste, and tends to sloppiness, for if the tar is applied in correct quantities and at the proper heat I find that these quickly run up. On a cold day this might not happen at once, but the material is there, and the next hot day will put things right.

With regard to gritting, ⅜-in. to ½-in. chippings should be used. Anything less than this would be detrimental.

I shall be pleased to give any surveyor the full working instructions which I issue to my workmen.—Yours, &c.,

S. SUTCLIFFE.

Council Offices,
Mytholmroyd.
August 10, 1915.

MRS. LILIAN BRADSHAW'S APPEAL.

To the Editor of THE SURVEYOR.

SIR,—I have read the letter of Lilian Bradshaw in your issue of the 30th ult. It is sad to feel that what is stated in this letter should be possible in the profession of municipal engineers and surveyors; but, alas! it occurs only too often. In many instances it is borne in silence.

With the inadequate salaries that are paid to a very large number of members of this profession it is impossible to provide against sickness, death, or old age, or adequately provide for their families. As you know, I am not a member of this profession, but I can count many hundreds of municipal surveyors among my friends, and I have always found them to hold the scales justly.

In your issue of August 6th a fund is suggested for this lady's assistance. In these strenuous times, with its many demands on our purse, it is not possible to subscribe generously to all, but I enclose herewith a cheque for five guineas, which I trust will be accepted for this good cause.—Yours, &c.,

J. E. WILLIS.

11 Poultry,
London, E.C.
August 6, 1915.

To the Editor of THE SURVEYOR.

SIR,—I have pleasure in enclosing you herewith cheque for £1 1s. for the fund you are raising for Mrs. Bradshaw.

Cannot she also obtain a grant of at least £10 from

the Orphan Fund of the Institution of Municipal and County Engineers?—Yours, &c.,

FRANK MASSIE.

Tetley House,
Wakefield.
August 7, 1915.

[We understand that Mrs. Bradshaw's case has been brought to the notice of Mr. O. Claude Robson, the hon. secretary of the Institution Orphan Fund.—Ed. SURVEYOR.]

To the Editor of THE SURVEYOR.

SIR,—In response to your notice in this week's issue of THE SURVEYOR, we have pleasure in sending cheque for small amount of two guineas.—Yours, &c.,

DODD & DODD.

County Chambers,
Corporation-street,
Birmingham.
August 7, 1915.

To the Editor of THE SURVEYOR.

SIR,—I enclose cheque for a guinea towards the fund you are raising for Mrs. Bradshaw, and hope you will be successful in raising a sufficient sum to meet her most pressing needs.—Yours, &c.,

A. J. P.

August 9, 1915.

To the Editor of THE SURVEYOR.

SIR,—*Re* the letter in your issue of 6th inst. and your footnote thereto, will you please take charge of enclosed postal order (5s.) for Mrs. Bradshaw?—Yours, &c.,

S. H.

August 11, 1915.

To the Editor of THE SURVEYOR.

SIR,—I herewith enclose postal order, 5s., and hope all who can will help.—Yours, &c.,

ANONYMOUS.

August 9, 1915.

To the Editor of THE SURVEYOR.

SIR,—I beg to enclose cheque (£3 3s.) for Mrs. Bradshaw's sad case.—Yours, &c.,

H. L. WETTERN.

16 Water-lane,
Great Tower-street, E.C.

A Tuberculosis Pavilion for Sunderland.—The Sunderland Town Council on Wednesday accepted a tender for the erection of a tuberculosis pavilion at the Ryhope sanatorium.

Municipal Employee's Rapid Promotion.—Lieut. V. E. Kerr, of 20th Service Battalion Northumberland Fusiliers (Tyneside Scottish), has been promoted to the rank of Captain and Adjutant. Prior to the war he was a cost clerk and time-keeper in the Birmingham Corporation roads department (Yardley district), a position he had held for four years. Before taking up this post he had been in the Army for twenty-one years, and was a colour-sergeant. He rejoined in the 1st Birmingham Battalion of the Royal Warwickshire Regiment as a company-sergeant-major, received a lieutenancy in the Northumberland Fusiliers, and is now a Captain.

Concrete Road Making in New York State.—According to Mr. H. E. Breed, deputy commissioner of the New York State Highway Commission, during 1914 all their concrete roads were built of plain concrete of the 1:2:3 mix. This year they are building with the same proportions, but some reinforcing is being tried where this pavement goes over clay sub-soil. New specifications were adopted in September, 1914, and the concrete roads being constructed during 1915 are built under these specifications. The sizes of coarse aggregate remain the same, but the use of gravel is strictly specified, so that it is confined to restricted regions of the state where the best quality of the material is available. The fine aggregate is more definitely specified on gradation and compressive strength. Last year the commission used a 7-in. depth at the centre and 5 in. at the sides. In order to obtain a parabolic section without increasing the quantity of concrete, the engineers are now using 6¾ in. at centre and 4¾ in. at the sides. The crown remains the same at ¼ in. per foot. The conditions coped with thus far require no reinforcement, except as stated for clay subsoil.

SEWAGE DISPOSAL AT WANSTEAD.

OPENING OF EXTENSIONS.

Extensions to the new sewage disposal works at Wanstead, Essex, were opened on July 24th, when a large number of guests were entertained by the urban district council. Among those present were Mr. W. R. Pryke, J.P., C.C., chairman of the Wanstead Council, Mr. W. W. Green, J.P., C.C., and other members of the council, together with the medical officer, Dr. Frank Argles, the clerk, Mr. Bruce Blewitt, the surveyor to the council, Mr. C. H. Bressey, and the engineer, Mr. J. Edward Willcox, M.INST.C.E. Among the guests present were Alderman W. P. Griggs, J.P., Mr. C. N. Tween, M.INST.C.E., engineer to the Lea Conservancy Board, Mr. W. Farrington, ASSOC.M.INST.C.E., surveyor to the Woodford Council, Mr. G. W. Holmes, ASSOC.M.INST.C.E., surveyor to the Walthamstow Urban District Council, Mr. J. Birch, surveyor to the East Ham Borough Council.

Mr. Willcox conducted those present round the works, and fully explained the various processes adopted for dealing with the sewage.

This is, we believe, the first installation of electrically driven distributors for rectangular filters in the London district. The method of distribution employed ensures perfect distribution, and also controls the intervals of time and the rate of discharge of sewage on to the beds.

The purchase of the sewage farm and the laying out of the original works by the late Mr. John T. Bressey date from 1880, when Wanstead might fairly lay claim to the picturesque title of a "village" (the population to-day exceeds 15,000). Sundry additions were made to the means of sewage disposal by Mr. J. T. Bressey and his successor, Mr. C. H. Bressey, F.S.I., from time to time as the population increased—contact beds, septic tanks, storm filters, &c.—and the area of the farm was gradually increased to its present area of 45 acres.

The great rise in population which has occurred in late years, however (more than 50 per cent between 1901 and 1911), and the increasing demands of sanitary science, necessitated the setting up of a complete modern plant, and the advice was accordingly sought of Messrs. Willcox & Raikes, who prepared the scheme now in operation. As an indication of the keen interest taken by the council, it may be mentioned that a committee of three councillors, Messrs. Pryke, Collyer and Clark, paid a mid-winter visit to several works in the Midlands in order to inspect the most recent developments of sewage treatment before committing the district to the new scheme.

The work designed by Messrs. Willcox & Raikes comprises the construction of new detritus tanks (24 ft. by 18 ft.), with mechanical screens, the subdivision and improvement of the old septic tanks, the formation of a humus tank (24 ft. by 24 ft.), the building of percolating filters (total area, 4,000 super. yards), with four electrically driven travelling distributors, the building of two motor-houses for the last-mentioned, the laying of a 21-in. outfall pipe from filter to river, the sinking of a deep sludge well to receive the sludge from tanks by gravitation, the laying out of five sludge lagoons, each 90 ft. by 40 ft., the provision of a 4-in. Stereophagus pump for the lifting of sludge from well to lagoons, the improvement of the old storm tank (470 ft. by 20 ft.) so as to increase its efficiency, while facilitating the removal of sludge by the installation of a portable Stereophagus pump, the erection of a manager's office, toolshed, store-sheds, and finally the laying out of paths and roads round the new works. The practical results of this most complete and up-to-date installation have fulfilled every expectation, and as useful means of auxiliary treatment the council still retain a large area of under-drained land for irrigation, and twelve old contact beds (each 60 ft. by 44 ft.).

The process now followed may be roughly summarised as follows:—

The crude sewage from the whole of Wanstead flows to the works through the old main outfall sewer (2 ft. 4 in. by 3 ft. 6 in.) traversing Wanstead Park. Passing through the detritus tanks and its screens the sewage is relieved of all the coarser, heavier solids, and then flows on to the settling tanks, where a further proportion of suspended matter is deposited. From here the liquid passes to the Dortmund tank, where a final deposition of suspended matter occurs, after which it is turned on to the percolating filters. In times of heavy sewage flow, or when it is desired to rest the filters, use can be made of the old contact

The Surveyor
And Municipal and County Engineer.

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beds of the under-drained grass-lands. Storm water is treated in a long series of open tanks divided by weirs.

"As a contrast to the modern developments displayed to visitors this afternoon," observed the surveyor, Mr. C. H. Bressey, F.S.I., in describing the works at the opening ceremony, "it is interesting to record that in the excavations for the humus tank there was discovered, 20 ft. below the surface, the thigh-bone of a rhinoceros who roamed through the valley in those silent days before the world was troubled with the problem of sewage disposal."

The contractors for the works are Messrs. W. & C. French, Buckhurst Hill, and the travelling distributors were supplied by Messrs. Hartley, Causton & Richmond, Limited, Stoke-on-Trent, and the Stereophagus sludge-lifting pumps by the Pulsometer Engineering Company; electric current is obtained from the Ilford Council's mains.

A loan of about £13,500 was sanctioned by the Local Government Board for the execution of the scheme.

Blackburn Borough Surveyorship.—The Corporation of Blackburn are advertising this week for a borough surveyor, at a salary of £800 per annum. Applications should be sent to Mr. Lewis Beard, town clerk, Town Hall, Blackburn, on or before September 4th.

Evesham Housing Scheme.—The Evesham Town Council on Wednesday adopted a scheme for the erection of fifty-two working-class dwellings at Bengeworth. The Local Government Board have approved the scheme, but intimate that they cannot sanction a loan in the present circumstances.

Derwent Valley Drainage Board.—The Order constituting a Drainage Board for the Derwent Valley has been confirmed. An area of about 10,000 acres has been scheduled in the lower reaches of the river, in the neighbourhood of Wressle and Bubwith, a much smaller area than that originally proposed. The Order contains a clause restricting the Drainage Board from borrowing except by the consent of the Treasury. It is probable, however, that a case of urgency will be made out to obtain the necessary funds to put the engineering work in hand, especially as there is every prospect of further floods if something is not done.

Wood Paving Maintenance Costs.—In his report for 1914-15, Mr. H. E. Stilgoe, M.INST.C.E., the city engineer, states that the area of wood pavement in Birmingham under maintenance contract with the Improved Wood Pavement Company is 129,004 sq. yds. The amount paid during the past year for such maintenance was £5,623, being at the rate of 10·46d. per sq. yd., this payment covering according to contract the cost of entire renewals where necessary. The approximate area of wood pavement maintained directly by the corporation is 203,314 sq. yds., the cost of which during the past year was £2,372, being at the rate of 2·80d. per sq. yd. This figure refers to repairs and cost of renewals where necessary.

ROAD MAINTENANCE IN KENT.

MR. H. T. CHAPMAN'S SECOND ANNUAL REPORT.

The second annual report of Mr. H. T. Chapman, the county surveyor, upon the maintenance and repair of the rural main roads of Kent, together with those main roads situated in non-retaining urban areas—*i.e.*, Bexley, Chislehurst, Cheriton, Dover, Footscray, Margate, Whitstable and Wrotham—contains a mass of interesting information.

The mileage of roads with which Mr. Chapman is concerned totals 600½, made up of about 580½ miles of roads in rural districts and nearly 20 miles in urban districts.

The actual cost of maintenance, tar-painting and improvement work carried out during the year ended March 31st last was £158,202. Towards this expenditure £38,756 was actually received in the account year from the Road Board, £1,974 is a credit due in respect of repairs to roads over railway and county bridges, and the sum of £6,815 is also a credit due in respect of contributions received towards the cost of improvements, purchase of old petrol lorries, scavenging, repairs to trenches, sale of old iron, &c., leaving a nett expenditure of £110,657 out of the county funds, which equals £184·3 per mile; £54,636 was expended upon tar-painting, widenings, kerbing, channelling, paving and drainage works, and represents £91·0 per mile.

The total cost of tar-painting carriageways amounted to £27,053, 942,480 gallons of tar having been used, the area treated being approximately 5,750,000 super. yds. There were also 20,224 gallons of tar used in the repairing of footpaths. The payments for tar alone represented £11,365, the average price paid per gallon being 2·7d.

To the urban authorities the county council paid £7,819 for the tar-painting of 1,557,340 super. yds. of carriageways. Tar-painting proper therefore cost the county council during the year £34,872.

During the year 2,450¾ tons of pitch and 393 tons of bitumen were used either as a matrix for binding granite macadam or the preparation of "carpeting" material. In addition to the foregoing the county also laid 810¼ tons of asphalt material. The value of the pitch used in the foregoing work was £5,822, and of bitumen £1,380, and the prepared carpeting material cost over £1,713, making a total of £8,916 for this class of material.

The total quantity of material used upon the roads under direct control was 143,404 tons or yards.

The average price per ton for granite macadam, exclusive of haulage, was 11s. 5·47d., as compared with 10s. 11·34d. in the previous year, this being an increase of 6·13d.

Of the total quantity of material used 50,962 tons consisted of granite macadam, and 26,766 tons of Kentish rag tarred macadam.

The maximum number of men employed was 720, and the minimum 480.

The amount paid in wages (including contribution under the Insurance Act of £366) was £40,611, as compared with £38,182 in the preceding year. In accordance with the scheme approved by the county council the sum of £888 was paid during the year to ninety-six workmen or their dependents who have either been called up for active service or have enlisted, and this amount is included in the total payments for wages.

The sum of £1,999 was charged against the year's working as depreciation upon land, buildings, plant and tools, and is made up as follows: One-fiftieth on land and buildings; one-tenth upon rollers, motors, trucks, &c. This depreciation represents a charge of £3·3 per mile.

Mr. Chapman mentions that the average daily cost of working a steam roller, including repairs, coal, oil, waste, scarifying tynes, insurance of driver and attendant, is 19s. 9d.; that of a steam motor, including all charges, £1 5s. 1d.; and that of a petrol heavy motor, £1 13s. 6d.

The total cost of haulage during the year amounted to £20,394, of which £12,782 was in respect of hired team labour and mechanical haulage.

In addition to the work executed by the county council's own steam rollers it was necessary to hire additional ones at a cost of £1,396.

EFFECTS OF THE WAR.

From April to September, 1914, owing to favourable weather conditions, the county's maintenance and improvement works were expedited and proceeded most satisfactorily, and had normal condi-

tions obtained throughout the year under review Mr. Chapman feels confident that an all-round improvement would have been apparent in the condition of the main roads generally. Since the commencement of the war, however, the operations of his department, in common with the general affairs of the county, have been seriously inconvenienced. During the autumn and winter months exceptionally wet and unfavourable weather conditions were experienced, and the increased traffic put upon the roads owing to military operations, combined with these disadvantages, has caused serious deterioration, particularly on the most important and heavily trafficked roads, which will be difficult to make good without incurring heavy expenditure. Supplies of granite from Belgium were cut off when war broke out, and during the remainder of the year it became necessary to obtain additional materials from other sources at greatly enhanced prices.

In his last annual report Mr. Chapman referred to the destruction and damage to his roads by quick and slow heavy traffic, and this, he now states, "is becoming more apparent. The necessity of strengthening the roads, and especially the sides of them, is becoming most urgent, and this must be done before surfacing with improved and more costly materials is proceeded with."

A large amount of subsoil and surface-water drainage is also required, and Mr. Chapman trusts that when the Road Board grants are available these necessary improvements will be expedited.

At the request of the Road Board, and for obvious reasons, the council deferred proceeding with many improvements towards which grants had been made, and the Bridges and Roads Committee has adopted the policy of curtailing as far as possible for the present expenditure on widenings, improvements of turns, kerbing channelling and making up of footpaths, which work can well stand over until more normal conditions obtain. Mr. Chapman, however, utters a word of warning. "It must be noted," he says, "that it would be a dangerous procedure and not tend to ultimate economy to defer urgent repairs to heavily trafficked and important main roads, as if these are neglected the reinstatement bill will be abnormally heavy." Efforts have been, as far as practicable, concentrated on the roads which are not only of county but national importance.

Very nearly half of the 600 miles of directly maintained roads are now carrying more or less frequent motor 'bus services, and there are very few towns and villages of any importance in the county that are not linked up. "It is a debatable point," observes the county surveyor, "as to whether the owners of heavy self-propelled vehicles should be more heavily taxed and the proceeds applied to the cost of maintaining the roads; but, be that as it may, there is no doubt that, in view of this increasing and damaging traffic, expenditure must be on the up grade if the roads are to be maintained to the necessary standard.

In a concluding note Mr. Chapman draws attention to the damage caused to macadam roads by the constant watering carried out by urban authorities, which, he remarks, is perhaps considered necessary for the amenities of the neighbourhoods, but is most destructive, and seriously increases the cost of maintenance.

Tar-spraying in Birmingham.—The cost of this work, states Mr. H. E. Stilgoe, M.INST.C.E., the city engineer, in his report for 1914-15, was £7,263, being at the rate of 0·911d. per super. yard. Mr. Stilgoe says the application of tar to the macadamised street surfaces has effected a saving in repairs, maintenance and scavenging, and is continuing to give satisfaction.

Village Water Supply in Leicestershire.—A new water supply for the village of Burbage, Leicestershire, was formally turned on recently by Mr. Charles Hands, chairman of the Water Committee. Addressing those present, Mr. Hands stated that the cost of the scheme was estimated at £4,400, but he was pleased to say that the work had been carried out for £3,700. At a subsequent luncheon reference was made to the admirable work of the engineer, Mr. E. H. Crump, ASSOC.M.INST.C.E., engineer and surveyor to the Hinckley Urban District Council, whose health was drunk. Mention was also made of the satisfactory manner in which the contract had been carried out by Messrs. G. Greaves and T. Bradbury.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is not Mr. Bertram Kershaw's suggestion for a simple garden refuse destructor just the very thing for which so many of us have been looking for years past? Do not all who have small gardens often suffer from the difficulty of disposing of the rubbish when the "rubbish heap" begins to get too big, and would not the cheap, simple, and evidently effective "Kershaw cremator" solve the problem for us in a thoroughly scientific manner?

* * * *

Could it be conceived as possible that a road of considerable importance in a rural district near London is now being "made up" in a really "good old-fashioned" manner? "Would you be surprised to hear," as eminent counsel sometimes put it, that the manner of repairing this road is as follows: Large flints as big, or bigger, than two fists are dumped on the road, shovelled over it, plenty of mud added, and a vast amount of water, and then rolled with a 10-ton roller? What the fate of this road will be in the near future is what one would like to know.

* * * *

What can be expected of some of our underpaid and overworked rural road surveyors, who receive such a pittance in the way of salary that they can scarcely find funds to leave their district to learn anything about roads or anything else? Is it not rather a matter of surprise that, under our present system of subdividing most of our municipal undertakings, the result is not infinitely worse than it is?

* * * *

Shall we not all wish that the invention and introduction of the "hydrodynamic collector-ejector" by that veteran in sanitation Mr. Isaac Shone will meet with the success it deserves? Is there not always a tendency, however, to adhere to known methods and to hesitate to introduce new systems, until time has proved that the new system has advantages over the old one? Would not a careful investigation of Mr. Shone's new system—full particulars with regard to which appeared in THE SURVEYOR of July 16th last—convince many who are now hesitating that it is a distinct advance on the ordinary methods of house drainage?

* * * *

Is not the syllabus of the Lectures in Civil and Municipal Engineering at the Leeds Central Technical School "just the very thing" to lay a foundation of knowledge for the municipal engineer of the future? Do they not embrace such useful subjects as sanitation, sewerage, hydraulics, water supply, road construction, bridges, tramways, sewage disposal, refuse destruction, &c.? Would not a young man who had attended these lectures be better equipped to take office as a municipal engineer than he would if he had not had the advantage of attending such lectures?

* * * *

Why is it that the Local Government Board will not sanction a loan for works of any kind if the local authority's men are to be employed in carrying out the work? Would it not be possible to get over this difficulty by temporarily discharging the men, then employing them on the work in question, and when it was finished reinstating them on the staff? Does it not seem curious that the Local Government Board should adhere to their cast-iron rules during a period when it is so necessary to get certain works finished without delay?

* * * *

Why is it that the Liverpool Corporation have only just awakened to the fact that a top hat and frock coat is not the most suitable costume for sanitary inspectors? Dignified as such a uniform may be, is it the right sort of clothing for a man who has often, in the course of his duties, to climb ladders, crawl into inaccessible places in search of cisterns, kneel or lie flat on the ground to inspect drains, and push his way into all sorts of verminiferous localities? Could any costume be more unsuitable for anyone engaged in these cheerful pastimes than a frock coat and tall hat?

* * * *

Was not the paper upon "Reinforced Concrete for Roads, Sewerage, &c.," read by Mr. Arthur E. Collins, city engineer of Norwich, at the annual

meeting of the Institution of Municipal and County Engineers, of absorbing practical interest which compares with some of the papers on this rather complicated subject presented at meetings of other institutions? But was not the question of the use of reinforced concrete for roads conspicuous by its absence? Should we not have liked to hear Mr Collins' views as to the suitability of concrete, we [illegible] as a material for the construction of roads, surfaces included? Have not some of the attempts in this country to make good concrete roads hitherto proved a failure?

ROAD MAINTENANCE AND ECONOMY.

By The Surveyor to the Hereford Rural District Council.

There is a great tendency at the present time for the matter of highway expenditure to come in for a great deal of criticism with a view to economy.

In The Surveyor of July 30th there was a short account of an M.P. asking questions respecting the curtailing of "excessive" main road expenditure by county councils. This appears rather an unnecessary question, as surely neither county councils nor other highway authorities will be guilty of spending where it is not absolutely necessary.

The trouble is how to economise without results being attained which will in the future cause such an extra expenditure as to prove that the attempted economy at the present time has proved false in every sense of the word.

A good many of these so-called economists consider that to proceed with bitumen-bound roads, or to tar-spray at the present moment, is unnecessary expenditure. This, in the first place, is a mistake, seeing that it is now proved that such roads are, without a doubt, cheaper than water-bound, where the traffic conditions render their provision necessary

Some councils are inclined (and have done so) to cut down the materials bill. There is no more false economy than this possible, for it brings in its train bad roads, with a greater expenditure, comparatively, later on than would be the case if the usual amount of material had been used.

It is therefore obvious that curtailment appertaining to road surfacing should not be entertained without serious consideration. Is it possible to save anything from the team or manual labour bill? It may be possible to spread a good deal of the material from the ditches upon the margins instead of employing hauliers to take it away, as is the custom in some districts where the brinker will not do so; but this is really a very small item.

Now, taking the manual labour bill, I think there is just a possibility, for the time being, to economise in this connection, although probably a good many fellow surveyors will not agree, and there are, no doubt, reasons for holding a contrary view. Personally, I think if all the back ditches are cleaned out, and all the outlets from the margins, and all siding or edging on pitches, and other very necessary places only were done, there could be a saving of at least 70 per cent. Of course, I admit it is not really advisable to neglect the siding, as it is very needful to draw off the water to the outlets; but I do think that if all the outlets were sided back for a yard or so no serious harm would accrue for, say, a period of twelve months. In any case, the harm would be much less than that caused by the reduction of the materials bill.

Taking a district containing 100 miles, and the cost of siding at 3d. per chain, or £2 a mile, a 70 per cent reduction would mean a saving of £140. In any case, every mile not sided would mean £2 in hand.

But what would become of the men? It is evident that the ordinary lengthman would not have enough work to keep him on full time. It would mean his getting other work for the time being, and would result probably in the surveyor losing him altogether.

It will thus be seen that economy in road maintenance with traffic continually increasing is almost an impossibility, and that where it is attempted great care, consideration and foresight should be exercised; otherwise, later on, when, possibly, taxation will be more felt than now, and labour and materials become more expensive, it will be found a very costly matter to restore our highways to their original condition.

It thus behoves councils with a taste for "economy" to be wary, and not rush headlong into trouble.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Belfast T.C. (August 4th. Mr. P. C. Cowan).—£72,000 for the purpose of carrying out street improvement works in the city.—It was stated that it was proposed to erect a bridge over the railway at Tate's-avenue at a cost of £31,000, and to complete street works in Tate's-avenue, Mill-street, Castle-street, and Great Edward-street; also to make alterations to gas and water mains. Alderman Shaw, chairman of the Improvement Committee, declared that there was an absolute necessity for completing the work in respect of which the loan was applied for, and it was therefore very necessary that the loan should be granted. Dealing with the necessity of having the railway bridge erected with the least possible delay at Tate's-avenue, he said the level crossing there had now been closed, with the result that considerable inconvenience was caused to people who had been accustomed to pass that way between Lisburn-road and Broadway. He would like to see the erection of the bridge put in hand at once, as it really had become a necessity.

Gosport and Alverstoke U.D.C. (August 5th. Mr. R. H. Bicknell).—£3,800 for additional machinery at the sewage air-compressing station.—It was stated that the dry-weather flow of sewage had increased from 4,000,000 gallons per week in 1904 to 7,500,000 gallons in 1915 through the six primary stations, and the wet-weather flow from 5,000,000 a week in 1904 to 20,500,000 per week in 1915 through the same stations. As a result of the extraordinary pressure on the engines two crank shafts on No. 1 engine were torn out of the fly wheels, and new cranks had to be fitted in 1911 at a cost of £200. The inspector expressed surprise at the enormous increase in the wet-weather flow. In all his experience he had never known such an immense increase. He suggested that there must be an extensive leakage into the pipes, and suggested that tests should be made. It was explained by the surveyor, Mr. H. Frost, that tests were made some time ago, and lengths of sewer pipes in waterlogged soil were relaid. After a discussion between the inspector, the engineer in charge of the station (Mr. Crosthaite), and the members of the council present, the inspector suggested that it would be cheaper to lay down new plant rather than repair the old plant. He should have to convince the Local Government Board whether the laying down of new plant or repairing of the old plant was the cheaper. He was not satisfied as to the cost of the proposed new machinery (£3,700), and insisted upon having more detailed reports. Otherwise he was sure the board would not grant the money. The members of the council, having discussed the situation among themselves, decided to postpone the application until the council had had time to consider the inspector's suggestions as to testing the sewers, the laying down of new plant, and the use of electricity at the air-compressing stations.

Pontypool U.D.C. (August 4th. Mr. F. H. Tulloch).—£4,000 for the erection of slaughter-houses, stables, and other buildings on a site in Lime Kiln-road.—Evidence was given by the officials of the council.

APPLICATIONS FOR LOANS.

Evesham T.C.—£11,275 for a housing scheme.

Islington B.C.—£9,276 for electrical mains and cables.

Listowel R.D.C.—£1,500 for works of water supply for Ballydali.

Nelson T.C.—£10,719 for the purchase of property for street improvement.

Newry No. 1 R.D.C.—£3,054 for a sewerage scheme.

Salford T.C.—£1,717 for electricity purposes.

LOANS SANCTIONED.

Dunmow R.D.C.—£950 for the completion of the sewerage scheme.

Wallsend T.C.—£1,100 for a motor fire tender and pump.

FORTHCOMING INQUIRIES.

AUGUST.	£
17.—**Christchurch.** For works of surface water drainage (Mr. F. H. Tulloch) ...	800
18.—**Huddersfield.** For works of sewerage (Mr. A. G. Drury)	26,000
20.—**Raunds.** For the provision of a cemetery (Mr F. H. Tulloch)	1,500

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

495. Radius of Gyration.—Explain from first principles the precise meaning and significance of the term "radius of gyration" as used in the investigation of the theory of beams.

496. Stand for Procession.—A stand with seats is required, from which to view a procession, upon a site 40 ft. by 10 ft. The front is to be 4 ft. above pavement behind some iron railings. Give section and part plan to a ¼-in. scale.

497. Gauging Sewers.—Describe a suitable method for gauging the flow of sewers.

498. Buttress Design.—Thirty feet (30 ft.) above the ground a rectangular buttress bears a thrust of 5,000 lb. inclined at an angle of 45 deg. If the buttress is to be 3 ft. wide, and is built of masonry 140 lb. per cubic foot, find its thickness. Also find the height of a turret 3 ft. by 3ft. necessary for stability at the top joint if the coefficient of friction=0·60. (E. P. C., *Birmingham.*)

499. Geodesy.—Describe generally (without details) the astronomical observations needed to locate the starting-point of a survey in a new country. (E. P. C., *Birmingham.*)

500. Sewage Tank.—A sewer discharging into a sea outfall is connected to a storage tank l feet in length, b feet in breadth, and h feet in height. The tank discharges directly into the sea by means of an orifice a square foot in area, connected to low-water level by a short pipe of the same area, the top of the tank being at high-water level. Neglecting losses due to friction, and assuming that no sewage is admitted to the tank during the period of emptying, that the tide has a range of r feet, and that the tide curve is harmonic, find approximately the time taken to empty the tank. (Stud.Inst.C.E.)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

494. Strength of Pillar.—A solid, square pillar, 10 ft. in height, with a section 2 ft. by 2 ft., and weighing 50 cwt., is subjected to a horizontal wind pressure of 28 lb. per square foot on one side. Assuming its material to be uniformly elastic, find the intensity of compressive stress at the leeward edge and at the windward edge of its base.

The stress at any point in the base of the pillar consists of two parts—

(*a*) A uniform compressive stress due to the weight of the material (represented by the height of the rectangle A B C D).

(*b*) A stress due to the bending produced by the wind pressure. This stress varies from a tensile stress at the windward side to a compressive stress of equal magnitude at the leeward side. Its magnitude is given by the height of the figure G E D F C G, in which C G is the tensile stress on the wind side, and D E is the compressive stress on the lee side.

The actual stress at any point is the sum of these two stresses and is represented by the cross-hatched figure.

If F is the uniform compressive stress due to the dead load and f_c and f_t the compressive and tensile stresses, due to bending—

then F−f_t = compressive stress at windward side of the base.

F+f_c = compressive stress at leeward side of the base.

(*a*) compressive stress F due to dead load

$$=\frac{50\times 112}{4\times 144}=9{\cdot}72 \text{ lb. sq. in.}$$

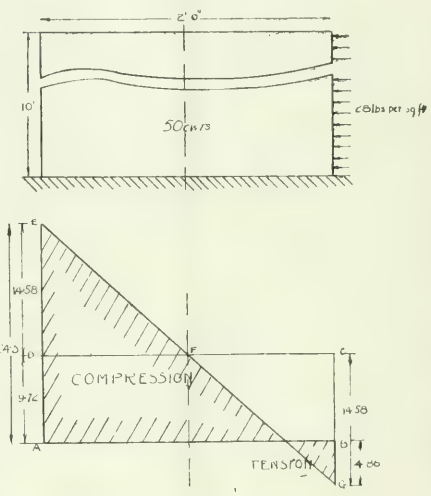
(*b*) Stresses due to bending.

$$f_c = f_t = \frac{M}{I}y$$

M = B M at the base

I = Moment of inertia of section about the central axis

y = Distance of extreme fibres from this axis



As for a cantilever with a uniformly distributed load

$$M=\frac{wl^2}{2}$$

w = load per unit length

l = length

At the base $M=\frac{28\times 2}{12}\times\frac{120^2}{2}=33600$ lb.-in.

$$I=\frac{bd^3}{12}=\frac{24^4}{12}\text{ (inch units) and } y=12 \text{ in.}$$

$$f_c=f_t=\frac{33600}{2\times 24^3}\times 12=14{\cdot}58 \text{ lb. per sq. in.}$$

Stress at windward side = 14·58—9·72

= 4·86 lb. sq. in. tension

Stress at leeward side = 14·58 + 9·72

= 24·30 lb. sq. in. compression

(W. R. H., *Fulham.*)

The stress produced due to the weight of pillar is equally distributed over the base, and is therefore equal to $\frac{W}{A}$ which is obviously a compressive stress (example 1).

Now consider only the stress produced by the side thrust; there will be a compressive stress on the side opposite the thrust and a tension stress on side of thrust (example 2).

If the pillar was rigidly fixed at base, we may consider it as a cantilever whose MB = P × d.

$$MB = MR \text{ and } MR=\frac{bd^2}{6}f_0 \text{ or } Zf_0$$

$$\therefore M(P\times d)=Z\left(\frac{bd^2}{6}\right)f_0$$

$$\therefore f_0=\frac{M}{Z}$$

Note.—f_0 = stress set up at maximum due to side thrust.

Now if we consider the combined stresses we get —

$$\text{Maximum stress} = \frac{W}{A} + \frac{M}{Z}$$

$$\text{Minimum stress} = \frac{W}{A} - \frac{M}{Z}$$

Note.—If $\frac{M}{Z}$ is greater than $\frac{W}{A}$ you get a tension stress at the base.

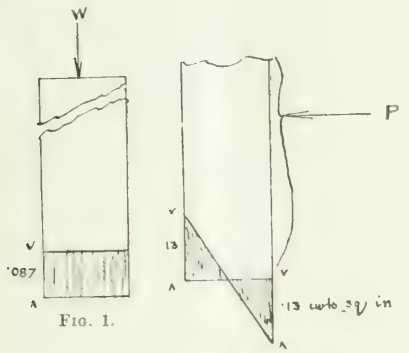


Fig. 1.

Fig. 2.

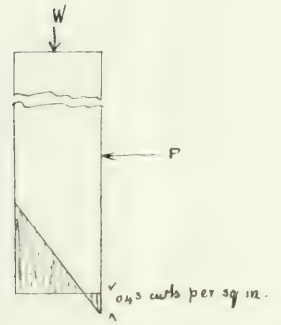


Fig. 3.

Using + for compressive stress and − for tension.

∴ In example we get $fc = \frac{W}{A} + \frac{M}{Z}$

W = 50 cwt.

A = 576 sq. in.

$$M = \frac{2 \times 10 \times 28}{112} + \frac{10 \cdot 12}{2} = \frac{2 \times 10 \cdot 28 \cdot 60}{112} = 300$$

$$Z = \frac{bd^2}{6} = \frac{24 \times 24^2}{6} = 2304$$

$$\therefore fc = \frac{50}{576} + \frac{300}{2304}$$

$fc = \cdot 087 + \cdot 13$

∴ $fc = \cdot 217$ cwt. per sq. in. (compressive stress)

$ft = \cdot 087 - \cdot 13$

∴ $ft = -\cdot 043$ cwt. per sq. in. (tension stress)

Note: Owing to bending stress being greater than the stress due to weight of column there will be a tension stress at the windward edge as per example 3.

(E. H., *Walkden.*)

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(1) Stress due to weight of pillar.

Weight of pillar = 50 cwt.

∴ Intensity of compressive stress at A and B due to weight of pillar $= \frac{50}{2 \times 2} = 6\frac{1}{4}$ cwt. per sq. ft. = 9·72 lb. per sq. in.

(2) Stress due to wind pressure.

Let W = total wind pressure

L = half weight of pillar

f = intensity of stress at A and B due to wind pressure

I = moment of inertia of pillar about AB (Fig. 2).

Then treating pillar as cantilever of length ½ height, fixed at AB, we have

Bending moment = moment of resistance.

$$\therefore W \cdot L = f \frac{I}{y} = fZ = f\frac{bd^2}{6}$$

where b is breadth and d is depth of cross-section

$$W = \frac{10 \cdot 2 \cdot 28}{112} = 5 \text{ cwt.}$$

$$\therefore 5 \times 112 \times 5 \times 12 = f\frac{2 \cdot 2 \cdot 2 \times 1728}{6}$$

$$\therefore f = \frac{6 \times 5 \times 112 \times 5 \times 12}{2 \times 2 \times 2 \times 1728} = 14{\cdot}583 \text{ lb. per sq. in.}$$

tension at A and compression at B.

The nett intensities are therefore

At A, 9·72 lb. per sq. in. compression − 14·583 lb. per sq. in. tension = 4·863 lb. per sq. in. tension, and at B, 9·72 lb. per sq. in. compression + 14·583 lb. per sq. in. compression = 24·303 lb. per sq. in. compression.

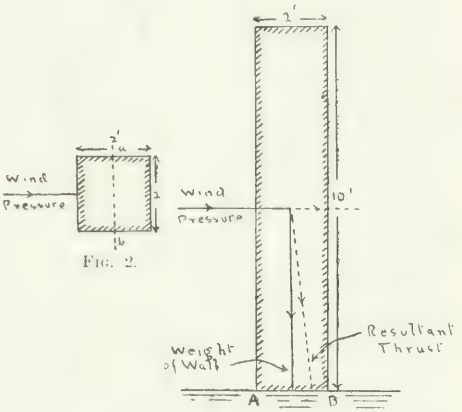

Fig. 2.

Fig. 1.

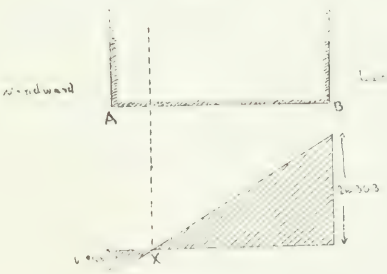

Fig. 3.

Fig. 3 indicates the distribution of stress over the cross-section, the neutral axis of the pillar being at X, the point of contraflexure of the diagram, the intensity of stress at this point being zero. If a diagram be plotted obtaining the resultant of the wind pressure and the weight of the wall, it will be found that the resultant line of thrust falls outside the middle third of the basal section, thus confirming the above result. (B. K., *Newport.*)

Waterford Electric Lighting Scheme.—In reference to the application of the Waterford Corporation for sanction to a loan of £30,000 for an electric lighting scheme, the Local Government Board wrote stating that the scheme submitted may, from an engineering point of view, be regarded as satisfactory, but, having regard to the present restrictions on borrowing by local authorities, the matter is one which must be postponed.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Bideford; housing and town planning—Dunfermline; roads and materials—Cirencester, Hertford, Winchester; sewerage and sewage disposal Midsomer, Northbeach; water, gas and electricity—Burnley, Macclesfield.—Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Aldershot U.D.C.—Plans have been completed of a public convenience in the Grove, the estimated cost being £831.

Bideford T.C.—Considerable surprise was expressed when it was reported that the estimated cost of the proposed joint isolation hospital for Bideford, Northam, and Abbotsham was between £8,000 and £9,000 instead of about £3,500 as previously supposed. It was stated that the architects considered the present plans the minimum the Local Government Board would pass, but the council passed a resolution that if the Joint Hospital Board sent up the plans to the Local Government Board they should consider whether considerable reductions could not be made, especially in view of the Local Government Board circulars on economising.

Brixham U.D.C.—Arrangements have been completed for the purchase of a site for an isolation hospital.

Chatham T.C.—The borough surveyor, Mr. C. Day, has been authorised to erect a public convenience in Fair-row.

Chester-le-Street U.D.C.—The Road Board have sanctioned a grant of £1,000 towards the cost of improving the town bridge, and the council have agreed to meet the cost of widening beyond the limit fixed by the Durham County Council, who will carry out the work.

Colchester T.C.—The borough surveyor, Mr. Harold Collins, reported that a deputation from the Glasgow Corporation had inspected the new War Office wards and extensions at the infectious diseases hospital, and had expressed great satisfaction at what they saw, stating that their visit would enable them to amend their plans for proposed new buildings, and to reduce their cost without loss in efficiency, and that, whereas the Glasgow scheme of extension worked out at £350 per bed, the War Office wards cost about £35 10s. per bed, and the tuberculosis and scarlet fever wards were estimated to cost £75 to £80 per bed.

Dundee T.C.—The town council's improvement scheme will probably be passed when Parliament resumes in September. Under its provisions it is proposed to borrow £270,000 for the clearance of a site and the building thereon of a new city hall with wings for business premises.

East Suffolk C.C.—It has been agreed to reconstruct the school at Henham, at an estimated cost of £1,051.

Folkestone T.C.—The Sanitary Committee have been asked to report upon the question of providing further public conveniences.

Kesteven C.C.—It has been agreed to erect a tuberculosis block at the council's infectious diseases hospital. A grant in aid of the cost will be contributed by the Local Government Board.

HOUSING AND TOWN PLANNING.

Dartford U.D.C. Provisional agreements have been entered into for the purchase of several sites for housing schemes.

Downpatrick R.D.C.—The Local Government Board, in answer to a proposal by the council to allow, owing to the war, an increase on their contract prices to the contractors for the erection of 213 cottages under the 1913 Improvement Scheme (Labourers Acts), have consented to allow £10 per cottage in the case of each cottage at present completed or actually in progress.

Dunfermline T.C.—The council recently gave their approval to an extensive town planning scheme embracing the whole of the area between the town and the Rosyth dockyard. The main features of the scheme are the arterial roads—Grange-road and Queensferry-road—which run seawards from the south of the existing town. Connected with various cross-roads these roads form the backbone of the scheme. The total immediate expenditure on the scheme is £124,000, including £100,000 for the main outfall sewer, and the other estimated expenditure required within the next fifty years will be £206,500, making a total of £330,500. The town clerk reported that he had visited London and conferred with the Treasury, the Scottish Office, and the Local Government Board in connection with the granting of a loan of £50,000 to the council for the purpose of investment in the Scottish National Housing Company. That company will build most of the houses in the Rosyth area. The town clerk said he had obtained a loan of the sum named at 4 per cent interest for a period of sixty years.

REFUSE COLLECTION AND DISPOSAL.

Bridlington T.C.—The question of the disposal of the town's refuse came up in a letter of the clerk to the neighbouring rural district council, which threatened the issue of a writ against the corporation if the practice of depositing rubbish in the rural district was not stopped. It was decided to ask the rural district council to meet a committee of the council to discuss the question of the site of a refuse depot.

ROADS AND MATERIALS.

Battle R.D.C.—The surveyor, Mr. Henry Blackman, raised the matter of steam rolling the roads, with a view to making the necessary arrangements for the ensuing year. He said no doubt the tenders would be higher owing to the increased cost of fuel. There was 3,300 yds. to be done, the same as before. A considerable amount of stone had been delivered, and if they had it placed on the roads they must have it rolled. He thought it would be false economy to leave the stone standing and not use it, now that it had been delivered. A total of 112½ days' rolling was done last year. It was agreed to ask the firms who tendered last year to tender again under similar conditions.

Cannock U.D.C.—A scheme is being considered for the widening of Uxbridge-street.

Cheltenham T.C.—The Street and Highway Committee recommend that the east side of Prestbury-road from the borough boundary to Windsor-street should be paved and kerbed, and that the footpaths in Windsor-street should be repaired.

Cirencester U.D.C.—The Local Government Board have provisionally sanctioned a loan of £1,200 for the improvement of Cricklade-street.

Croydon T.C.—It has been decided to carry out an improvement in Brighton-road, at an estimated cost of £120.

Dublin T.C.—A deputation from the city council has been appointed to wait on the Provost and Board of Trinity College on the subject of the acquisition by the corporation of a small plot of ground at the corner of Grafton-street and Nassau-street, with a view to widening that portion of the street.

Egham U.D.C. The surveyor, Mr. W. Menzies, has been instructed to inspect and obtain particulars of a combined motor water van and roller belonging to the Chertsey Urban District Council, in view of a proposal to purchase a similar machine for this council.

Finchley U.D.C.—It is proposed to carry out a widening scheme at Hendon-lane, near Christ's College.

Godalming T.C.—The council have applied to the Road Board for a grant of £100 for the making up of Chalk-road from Meadrow to the goods-yard entrance. They have not, in this year's estimates, made any provision for improvements, and only repairs necessary for the proper maintenance of the district roads will be carried out. The estimate for the district roads for the year ending March 31st last was £2,168, and the actual expenditure £1,684.

Gower R.D.C.—It is proposed to take up a loan of £420 for the new road at Blackpill.

Halifax T.C.—It has been decided to carry out [illegible] street works at Sowerby, at an estimated cost of £429.

Hertford T.C.—It is announced that the Great Northern Railway Company will give the land and contribute £1,000 towards the proposed new road from Nelson-road to North-road. The scheme will not be begun until six months after the war.

Hove T.C.—An apportionment, at £1,137, has been approved for making up 1,005 ft. of Langdale-road as a new street. The borough surveyor, Mr. H. H. Scott, has received instructions to prepare an estimate for making up Mainstone-road.

Maidstone R.D.C.—The surveyor, Mr. T. A. Busbridge, informed the council that he had given evidence before the Departmental Committee appointed by the Local Government Board to consider the law and regulations relating to the construction and use of road locomotives and heavy motor cars in Great Britain. He also gave a resume of the papers read and the discussions which followed at the recent Road Conference, which he attended, and said it was shown that the life of water-bound roads in rural districts was materially increased by treating their surface with tar.

Newcastle (Ireland) U.D.C.—The tenders of Mr. Wigg, at an aggregate of £300, have been accepted for steam rolling.

Newry U.D.C.—The council last week passed accounts totalling £476 in respect of dilapidated property which had been acquired for the purpose of opening up a new street between Upper Water-street and Lower North-street. Mr. Ruddy asked how much the scheme would cost. The clerk said the loan which they had got for the acquisition of the property and the making of the new street was £770.

Norham and Islandshires R.D.C.—The Road Board have sanctioned a grant of £200 towards the cost of the tar treatment of the roads.

South Stoneham R.D.C.—The Road Board have agreed to contribute £1,050 towards the cost of the repair of the roads in North Stoneham and South Stoneham parishes.

Ticehurst R.D.C.—The council have adopted the advice of the surveyor, Mr. W. N. Wood, to tar the following roads—viz.: Wadhurst to Mark Cross, at a cost of £235; Ticehurst to Flimwell, at a cost of £118; and ½ mile of Ticehurst Village, at a cost of £43. As the surveyor was of opinion that road stone would not be delivered this coming winter, it was decided that repairs with stone should not be carried out.

Winchester T.C.—The city surveyor, Mr. W. V. Anderson, has received instructions to prepare an estimate of the cost of wood paving part of High-street. The question of the improvement of Bridge-street is also being considered.

York T.C.—The city engineer, Mr. F. W. Spurr, has been asked to obtain information from other towns with respect to the cost of a motor sweeper, and to obtain quotations for a tank for fixing on to a motor wagon.

SEWERAGE AND SEWAGE DISPOSAL.

Chichester T.C.—It has been agreed to effect repairs to the extent of £72 to the electric battery at the sewage works, and that the disused motor be converted into a dynamo, at a cost of £5.

Easington R.D.C.—The council have made another appeal to the Local Government Board to allow the Haswell-to-the-sea sewage disposal scheme to proceed. It is pointed out that the council would lose over £5,000 if the work was not allowed to go on.

Macclesfield R.D.C.—A scheme of sewerage for Poynton has been prepared, and is being considered by the parish council. The estimated cost is £345.

Middleton T.C.—The corporation have completed the construction of the sewer necessary for connecting the sewer of Middleton to the Manchester Corporation main sewerage system, but the actual connection has not yet been made.

Midsomer U.D.C.—Having agreed that the present sewage disposal works at Wilton were too limited for extension, the council have instructed the surveyor, Mr. C. H. Sunderland, to prepare the necessary plans and specifications for a new sewage disposal scheme on the septic system, to be constructed on the irrigation land at Old Welton, providing for a population of 6,000 (this being an increase of 50 per cent of the population now drained to the present works); also to carry out inexpensive experiments in filtration, and to obtain all such particulars and analyses as may be required when the period arrives for an application for a loan to be made to the Local Government Board for carrying out the construction of the scheme.

Newcastle (Ireland) U.D.C.—Messrs. Swiney & Croasdaile, engineers for the sewerage scheme, reported that the additional cost of the outfall sewer under the present arrangement as compared with the former contract would be £750.

Northleach R.D.C.—Plans for a sewerage scheme for Southrop have been prepared by Messrs. Phillott & George, of Cheltenham, and they have been forwarded to the parish council for their consideration.

Oldham T.C.—The Local Government Board have refused to sanction a loan of £485 for the proposed installation of four additional grease retorts at the sewage works.

Watford U.D.C.—The nett profit on the sewage farm accounts for the year ended March 31st was £48, as compared with £2 last year.

WATER, GAS, AND ELECTRICITY.

Barking U.D.C.—Tenders have been accepted, at £13,536, for electrical extensions.

Bridgnorth T.C.—The council have approved of the curtailment of public lighting during the coming winter, in the interests of economy and for other reasons brought about by the war.

Burnley T.C.—The corporation are seeking extended borrowing powers for the completion of the new waterworks now in course of construction at Hurstwood. In the course of the present municipal year the original loan of £215,000 will be exhausted, and the corporation have asked the Local Government Board to sanction a further loan. The Treasury have intimated to the town clerk their desire that the corporation should suspend the works until after the war. The Water Committee have decided to ask the Local Government Board to receive a deputation as to the urgency of proceeding with the work and of sanction being given to further borrowing powers.

Chelmsford T.C.—In connection with the acquisition of the local gasworks undertaking, it has been decided to erect a new gas-holder, at an estimated cost of £10,000.

Chesterfield T.C.—The town council are recommended by the Electrical Energy Committee to carry out extensions of the electricity undertaking, at an estimated cost of £15,200.

Guildford T.C.—The borough surveyor, Mr. E. Y. Harrison, who has prepared a special report on the town's water supply, has received instructions to obtain prices of new and second-hand pumps for Joseph's-road works, capable of delivering 20,000 gallons per hour. He has also been asked to prepare a plan of the whole of the mains of the borough.

Lisburn U.D.C.—It has been agreed that the question of increasing the water supply should be taken into consideration without delay. It was hoped that the scheme proposed would not exceed £3,000.

Lurgan U.D.C.—The council have passed a resolution empowering the Gas and Electric Light Committee to negotiate for the raising of £47,000 required for the purchase of the gasworks.

Macclesfield T.C.—The town council are seeking authority to their scheme for the improvement of the waterworks, at an estimated cost of £3,300.

Plymouth T.C.—At the Water Committee meeting the town clerk reported on the powers contained in the Plymouth Corporation Bill, which has passed the third reading in the House of Lords, with respect to the extension of the main for conveying water from Burrator, and the water engineer submitted a report in which he recommended the construction of a 33-in. pipe, at an estimated cost of £60,000, the powers for borrowing which sum had been included in the Bill and which had been sanctioned by the Treasury. The recommendation of the water engineer was adopted, and it was decided to invite tenders for the necessary pipes and materials in time for the next meeting of the committee.

Stirling T.C.—It is announced that the Stirling Waterworks Commissioners have agreed to provide a water supply for Stirling, if required, from the Grangemouth reservoir at Bannockburn.

Stoke-on-Trent T.C.—A proposal has been approved for the erection of a sub-station for the supply of current to Messrs. Kerr, Stuart & Co. The cost is estimated at £1,085.

Tanderagee R.D.C.—It has been resolved to carry out a scheme of water supply for Laurelvale by the improvement of the existing wells.

Wednesbury T.C.—Consideration is being given to proposals for the purchase of additional electricity plant and cables.

Wincanton R.D.C.—With respect to the proposed water supply for Templecombe, the Local Government Board wrote stating that, though they were unable to hold out any hope of a loan being sanctioned for the scheme under existing conditions, they were prepared to consider the application to the extent of a local inquiry with a view to the scheme being proceeded with when the circumstances permit. The board observed that the mains proposed to be laid under the scheme would pass through several other parishes (both in the Wincanton and Mere rural districts) which would be in need of a satisfactory water supply, and they would be glad to learn whether the question of a joint scheme had been considered.

Worcester T.C.—The electricity engineer recommends the city council to instal certain new electricity plant and extensions.

MISCELLANEOUS.

Athlone U.D.C.—The council have received no tenders in reply to the advertisement for the annual coal supply to the gas-house for lighting purposes. The old contractors stated that the markets were so disturbed that they could not tender at present, but hoped to do so in a few days. The gas manager said the coal supply was running out, and, in order not to leave the town without light, it was decided to wire to Messrs. M'Kilvie asking them to quote for a single cargo of coal.

Chatham T.C.—It has been agreed to purchase a team tractor and two trucks, at a cost of £625.

Scarborough T.C.—Mr. Briggs has given notice of motion that the council meet in committee early to consider—(1) in what way further retrenchments in the general expenditure of the council could be made, (2) what reduction could be made in the salaries of officials, and to what extent the staffs could be reduced. Nearly all the members rose when the motion was reached at Monday's meeting, and Mr. Briggs thereupon withdrew it.

PERSONAL.

Mr. P. J. O'Loughlin, Athlone, has been appointed engineer to the Athlone Rural District Council.

Mr. F. Read, surveyor to the Gelligaer Urban District Council, has joined the colours, and Mr. T. R. Gabe, deputy surveyor, has been appointed to take charge of the surveyor's department.

Mr. T. L. Oliver, B.Sc., Assoc.M.Inst.C.E., engineer and surveyor to the Conway Rural District Council, has been appointed surveyor and inspector to the Llandrindod Wells Urban District Council.

Mr. H. Hunter, sanitary inspector to the Maldens and Coombe Urban District Council, has received much sympathy on the death of his wife. Mr. Hunter is now serving as a captain in the Army Service Corps.

Mr. F. W. Smart was at the last meeting of the county council appointed deputy county surveyor for Bedfordshire. Mr. Smart has been chief assistant to the county surveyor for the past six years and a-half, and previous to that was for seven years and a-half district surveyor for the western district of the county.

Mr. J. S. Mant, deputy surveyor and inspector to the Steyning East Rural District Council, will join H.M. Forces in September. Mr. F. Slaughter, Assoc.M.Inst.C.E., surveyor and inspector of nuisances, Steyning West Rural District Council, will undertake the duties during the absence of Mr. Mant, if required.

Mr. A. G. Wheeler has been appointed assistant in the Colchester borough surveyor's department. The town council have appointed Mr. A. G. Andrews draughtsman and building surveyor, at a salary of £150, rising by £5 yearly to £155. They also resolved that the salary of the borough surveyor's chief clerk be raised from £137 10s. to £145 yearly, and by annual increments of £5 to a maximum of £155.

Mr. J. Fred Hawkins, county surveyor for Berkshire, has received a commission in the Royal Engineers as temporary captain on the staff of General Gibbon, R.E., and proceeds to the Mediterranean in a week's time. Mr. Hawkins, who is a valued county officer, will be greatly missed, and it is hoped that he may soon be welcomed back to his responsible duties. His many friends at Tilehurst (where he resides) heartily congratulated him on his appointment.

Mr. Oswald A. Bridges, the town surveyor of Bognor, on Saturday afforded a further illustration of the muncipal surveyor being the "handy man" of the engineering profession. A picturesque procession traversed the main streets of this delightful seaside resort, and Mr. Bridges was responsible for several of its most attractive items, including a vast horse-drawn model lobster, representing the fishing industry, a realistic submarine, a lifeboat rescue, and other tableaux of clever design and execution. Somehow, too, Mr. Bridges had been able to raise a real live Russian bear. His versatility will be rewarded by resulting in the raising of some £150 for the District Nursing Association and the Royal West Sussex Hospital at Chichester.

Barnsley Town Council decided this week to advertise for an assistant sanitary inspector at a salary of £104 per annum.

OBITUARY.

Mr. Robert Hammond, whose death is reported, was probably the best-known electric consultant in the country, and certainly one of the foremost men in connection with municipal electricity works. He is said to have been the first man in Great Britain to lay down works where electricity was distributed from a centre for electric lighting, and the first in the field with a book on private house electric lighting.

Mr. F. G. Taylor, building surveyor to the Sunderland Corporation, a position he had held since 1883, died last week, we regret to state. A native of the town, he had been in the service of the corporation since 1873. A few years ago he took an active part in preparing the building by-laws now in force, and he had since 1883 had the supervision of all the dwelling-houses erected in the borough. Mr. Taylor leaves a widow, three sons and a daughter. His eldest son is an engineer at Buenos Ayres.

FOR OTHER ADVERTISEMENTS

See End of Paper.

CLERK OF WORKS.—Required at once, two Clerks of Works for Bridge Works, probably four months and two months respectively. Apply, giving full particulars of experience, copies of testimonials and salary required, to John Anstee, C.E., District Surveyor, Commercial-road, Guildford. (2,676)

JUNIOR ASSISTANT. Required, young Assistant, clerical and general. Apply, giving full particulars of qualifications and salary required, to John Anstee, C.E., Commercial-road, Guildford. (2,677)

METROPOLITAN BOROUGH OF DEPTFORD.

APPOINTMENT OF BOROUGH SURVEYOR.

The Council of the above Borough invites applications from qualified persons for the above appointment. Salary £450 per annum, rising by annual increments of £25 to a maximum of £550 per annum.

The appointment will be subject to the conditions set out in the form of application.

Applications, accompanied by copies of not more than three recent testimonials, must be made upon forms to be obtained from the undersigned, and must be returned not later than 9 a.m. on Tuesday, the 31st August, 1915.

Canvassing any member of the Council, either personally or indirectly, will disqualify candidates. The term "canvassing" includes any oral or written communication made to a member of the Council, either by or on behalf of the candidate relative to the appointment.

ARTHUR PURKIS,
Town Clerk.

Town Hall,
New Cross-road, S.E.
August 10, 1915. (2,675)

WARWICKSHIRE ROADS.

A YEAR'S WORK.

The annual report of the county surveyor of Warwickshire, Mr. John Willmot, states that the nett expenditure on the roads in the county outside the Road Board scheme amounted during the year 1914-1915 to £52,846, or, deducting the cost of improvements, £51,559, which is equal to a rate of £112·3 per mile.

Mr. Willmot mentions that upwards of 4,000 tons of tarred material were used during the period covered by the report. Referring to the employment of tarred chippings in the repair of potholes, he observes that this is an excellent material for this purpose if properly applied at the right time, but very unsatisfactory otherwise.

The average price per ton of the granite and other hard stone, including breaking, was 8s. 9d., of the slag 5s. 4d., and of the tarred material 13s. 1d. The average prices for last year were 8s. 3d., 5s. 3d., and 12s. 3d. respectively.

TEAM LABOUR.

The quantity of material hauled by piecework on to the roads from the various wharves and railway stations was 46,000 tons, the cost amounting to £4,565.

The average cost per ton per mile was 9·2d. as against 7·7d. for the previous year, but as less material was hauled by piecework, the cost of the work was practically the same as last year. The average rate per ton per mile is the highest that has been paid for more than twenty years. For the twelve years 1900-11 it hardly varied, and averaged 8·1d. per ton per mile.

It appears that in some districts there has been great difficulty in getting the work done, and Mr. Willmot had to use the council's combined roller and tractor as a tractor only during the whole year. By this means 3,400 tons were delivered on to the roads at a cost of £287. The tractor worked under very adverse circumstances, as, owing to the irregular delivery of material, it was often detained at stations, and could not be continuously at work. For this reason the cost of working forms no guide to the expense of working a tractor under normal conditions.

In regard to daywork carting, the report states that the average charge for a man, horse, and cart was formerly 7s. 6d. a day. The average for the past year was 7s. 11d., varying from 7s. 4d. in one district to 8s. 6d. in another. In individual cases the charge was as much as 9s. 6d. per day.

TARRING.

For the first time since the council undertook the work, the whole of the surface tarring was done by the council's own men. Favoured by the weather, nearly 1,000,000 sq. yds. were tarred, which represents 110 miles of road, or almost one-fourth of the total mileage directly maintained by the council. "Undoubtedly," says the county surveyor, "the surface tarring of newly metalled roads has increased the life of the roads, and so lessened the cost of maintenance."

The cost of the whole of the work was 1·39d. per super yd., as against 1·27d. for similar work done by the council's own men and 1·38d. for work done by contract in the previous year.

DAMAGE BY MOTOR-'BUS TRAFFIC.

Motor omnibus traffic on the main roads greatly increased during the year. There were fifteen main roads with a mileage of 75½ affected by it. The total extra weight was nearly 1,400 tons daily. Most of the 'buses were of the single-deck type, and the weight of each unladen was 4½ tons—the average weight laden being 6 tons. That the matter was of serious importance was shown by the fact that on one section of the road the additional daily weight it had to bear was 212 tons, which was more than all the other traffic on the road together.

There was no question of the damage done to the ordinary water-bound roads subjected to motor-omnibus traffic, those with poor foundations suffering most severely. The peculiar effect on the roads where the traffic was at all heavy was very noticeable. It first produced a wavy condition of the surface, the "waves" following each other in a natural sequence, and when eventually the crust of the road was broken through disintegration followed very rapidly, with disastrous results. Fortunately, so far, only one of the roads affected in Warwickshire had collapsed under the traffic, though several were getting into bad condition.

Mr. Willmot adds that the effect of this traffic on roads with good foundations, and coated with tarred material, was as yet scarcely noticeable as compared with the effect on weak water-bound roads. He was satisfied that where a water-bound road was subject to a heavy traffic of this nature it would be necessary and more economical in future to strengthen the foundations and coat the surface with tarred material.

ROAD BOARD SCHEME.

The work under this scheme progressed steadily during the whole of the year, but, in the same way as the ordinary road work, it was hindered by unavoidable causes. However, it is rapidly approaching completion, and with the exception of two short lengths on the Watling Street at Atherstone, which it has been decided to postpone for the period of the war, the work is expected to be finished before the [illegible].

The delay in carrying out the work naturally led to an increase in its cost, and the rise in wages and material also contributed to the same end. With every desire for economy, therefore, it had been found impossible to keep the estimates—which were prepared more than two years ago—within their original limits.

In the estimates it was provided that certain hills should be coated with Tarmac in the centre only, leaving a strip of water-bound macadam on either side. This plan was, however, in practice found to be very unsatisfactory, as it was impossible to keep the water-bound strips in order without continual attention and expense. The tarred portion of the road had, in fact, exactly the same effect as a tramway upon it, and the macadam strips were as troublesome to maintain on one road as on the other. It had been found best, therefore, to coat the full width of the road with Tarmac where the gradient did not exceed 1 in 25, and to use only water-bound material over the full width where the gradient was greater.

The thickness of the coating of Tarmac when consolidated was 3 in., except on the Birmingham and Coventry road, where, owing to the excessive and increasing traffic, it was decided to increase the thickness to 4 in. when consolidated.

Up to March 31st last the scheme had cost £50,605, being £21,398 for foundation work done by the council's own men, and £29,207 paid to the contractor for surfacing the roads with Tarmac. Towards this the council so far have received from the Road Board by way of grant £40,000 and a loan of £23,410 free of interest, the first annual instalment of which—namely, £3,901—was paid back in March.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. H. T. WAKELAM, M.INST.C.E., County Engineer of Middlesex.

EASTERN SUB-DISTRICT (NORFOLK, SUFFOLK AND CAMBRIDGE).

Mr. Robert Croome, the engineer and surveyor to the Cromer Urban District Council, has arranged to have a sub-district meeting at Cromer on Saturday, August 21st.

PROGRAMME.

12.30 p.m.—Meet at council offices, where Mr. D. Davison, J.P., C.C., chairman of the Cromer Urban District Council, will receive the members.

Read minutes of previous meeting.

Discuss "How to put more life into the Eastern Sub-District," which subject will be opened by Mr. R. Croome.

1.30 p.m.—Lunch at the Hotel Metropole. Tickets 2s. 6d. each.

2.30 p.m.—Discussion on "Road Tarring," which will be opened by Mr. R. Croome, who requests that, as far as possible, each member present will state his experience and give cost where possible per square yard.

4.30 p.m.—Afternoon tea at "The Warren," by kind invitation of Mr. F. H. Barclay, J.P., chairman of the Highways Committee. Mr. Barclay will be pleased to show members the gardens after tea.

Either before 12.30 or after tea visits will be arranged to the storeyard, electric light

works, fire station or destructor, if the members desire.

All members of the institution are cordially invited to attend, and, in order that the necessary arrangements may be made, members must give notice not later than Saturday, August 14th, of their intention to be present.

J. R. Mead, *Hon. Sub-District Secretary,* Ipswich.
H. T. Wakelam, M.Inst.C.E., *District Chairman,* Middlesex.

It is hoped to be able to arrange with Mr. W. Lionel Jenkins, the county surveyor for West Suffolk, to have a sub-district meeting at Bury St. Edmunds in the near future.

ROYAL SANITARY INSTITUTE.

PROVINCIAL SESSIONAL MEETING, BRIGHTON.

A sessional meeting will be held on Friday and Saturday, September 3rd and 4th, in the Permanent Art Gallery, Brighton, at 10.30 a.m., when discussions will take place on "Indian Sanitation," "Camp Sanitation," and "The Final Report of the Royal Commission on Sewage Disposal."

The chair will be taken each day at 10.30 a.m. by Sir Henry Tanner, C.B., I.S.O., F.R.I.B.A. (chairman of the council of the institute). Vice-chairmen: H. Percy Boulnois, M.Inst.C.E., Louis C. Parkes, M.D., D.P.H., Colonel J. Lane Notter, M.A., M.D., R.A.M.C.

Tickets for admission of visitors may be had on application to Dr. Duncan Forbes, medical officer of health, Town Hall, Brighton, who is kindly acting as the local hon. secretary of the meeting; and of E. White Wallis, secretary.

Programme.

Friday, September 3rd.

10.15 a.m.—His Worship the Mayor (Alderman J. L. Otter, J.P.) will welcome the members of the institute to Brighton.

10.30 a.m.—Discussion on "Indian Sanitation."

1—"Sanitary Problems in Hospitals for Indian Troops in England," by Major S. P. James, M.D., I.M.S., the Kitchener Hospital, Brighton.

2—"The Use of Storm-water Drains to Ensure Safe Water Supplies being Obtained from Polluted Catchment Areas," by Major C. C. Murison, I.M.S., staff officer, the Kitchener Hospital.

12 noon.—Discussion on "Camp Sanitation" to be opened by Lieut.-Colonel H. R. Kenwood, M.B., R.A.M.C.

2.30 p.m.—Visit to the Kitchener Indian Hospital. The party will assemble at the North Gate of the Royal Pavilion, close to the library, and will proceed by car.

3 p.m.—Visit to the Royal Pavilion Indian Hospital. The party will assemble at the North Gate of the Royal Pavilion, close to the library.

8.30 p.m.—Reception by his Worship the Mayor at the Permanent Art Gallery.

Saturday, September 4th.

12 noon.—Discussion on "The Final Report of the Royal Commission on Sewage Disposal" to be opened by Samuel Rideal, D.Sc., F.I.C., and J. D. Watson, M.Inst.C.E. (engineer to the Birmingham, Tame and Rea District Drainage Board).

2.30 p.m.—Visits will be made to Shoreham Camp and the Brighton electricity works.

STUDENTS' LECTURES.

The fifty-ninth course of lectures and demonstrations for sanitary officers will commence on Monday, September 20th.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

WORKING HIGHWAY SURVEYOR.—August 14th.—Keighley Rural District Council.—Mr. J. N. Clarkson, 40 North-street, Keighley.

SURVEYOR AND INSPECTOR.—August 21st.—Abergele and Pensarn Urban District Council. £100 per annum.—Mr. E. A. Crabbe, clerk, Town Hall, Abergele.

CLERK OF WORKS.—August 21st.—Conway and Colwyn Bay Joint Water Supply Board. £3 per week.—Mr. R. Jones, clerk, Castle-street, Conway.

WORKING AND GENERAL FOREMAN.—August 21st.—Sandgate Urban District Council. 32s. 6d. per week.—Mr. D. V. Howard, engineer and surveyor, Council Offices, High-street, Sandgate.

SURVEYOR, INSPECTOR AND COLLECTOR.—August 23rd.—Buckfastleigh Urban District Council. £150 a year.—Mr. E. Windeatt, clerk, 19 High-street, Totnes.

SURVEYOR.—August 23rd.—Halesowen Rural District Council. £160 per annum.—Mr. E. H. Grove, clerk, Church Steps House, Halesowen.

SEWAGE WORKS ENGINEER.—August 24th.—Corporation of Bedford. £2 10s.—£3 per week, with house.—Mr. N. Greenshields, borough engineer and surveyor, Town Hall, Bedford.

MECHANICAL ENGINEER AND FOREMAN.—August 24th.—Corporation of Bedford. £2 10s.—£3 per week.—Mr. N. Greenshields, borough engineer and surveyor, Town Hall, Bedford.

PERMANENT WAY FOREMAN.—August 28th.—Corporation of West Ham. £3 5s. per week.—Mr. J. S. D. Moffet, general manager, Tramway Offices, Greengate-street, Plaistow, E.

FOREMAN PLATELAYER.—August 28th.—Corporation of West Ham. £2 5s. per week.—Mr. J. S. D. Moffet, general manager, Tramway Offices, Greengate-street, Plaistow, E.

ASSISTANT ENGINEER.—August 28th.—Corporation of West Ham. £250 per annum.—Mr. J. S. D. Moffet, general manager, Tramway Offices, Greengate-street, Plaistow, E.

SURVEYING ASSISTANT.—August 28th.—Corporation of West Ham. £117—£120 per annum.—Mr. J. S. D. Moffet, general manager, Tramway Offices, Greengate-street, Plaistow, E.

CHIEF STOREKEEPER.—August 30th.—Corporation of Birmingham. £156 per annum.—Mr. Henry E. Stilgoe, city engineer and surveyor.

BOROUGH SURVEYOR.—August 31st.—Deptford Borough Council. £450 per annum.—Mr. A. Purkis, town clerk.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

HAVERFORDWEST.—August 16th.—For repairs to certain properties, for the corporation.—Mr. J. R. Edwards, borough surveyor.

BELFAST.—August 17th.—For improvements at the fever hospital, for the board of guardians.—Mr. A. Ferguson, surveyor, Scottish Provident Buildings, Belfast.

MANCHESTER.—August 18th.—For an addition to the Withington Institution, for the board of guardians.—Mr. J. Macdonald, clerk, Poor-law Offices, New Bridge-street.

KENT.—August 19th.—For repairs to a school at Northfleet, for the Education Committee.—Mr. W. H. Robinson, architect, Sessions House, Maidstone.

GLAMORGAN.—August 19th.—For the building of new schools and constructing foundations of a temporary building, for the county council.—The Clerk, County Hall, Cardiff.

CHELMSFORD.—August 23rd.—For the erection of a temporary engine-house and other incidental works, for the corporation.—Mr. P. T. Harrison, borough engineer, Municipal Offices.

EDMONTON.—August 25th.—For the erection of two temporary buildings, for the board of guardians.—Mr. J. C. S. Mummery, architect, 13 Fitzroy-square, W.

Engineering: Iron and Steel.

EARBY.—August 16th.—For the supply of dynamo, battery and wiring, and other incidental work in connection with electric lighting at the sewage works, for the urban district council.—Mr. J. E. Aldersley, engineer and surveyor, Council Offices.

BRISTOL.—August 23rd.—For the supply of a 6,000-kw. three-phase steam turbo-alternator, with

condensing plant, for the Electrical Committee.—Mr. H. Faraday Proctor, chief engineer, The Exchange, Bristol.

PLYMOUTH.—September 2nd.—For the supply of 33-in., 25-in. and 9-in. sluice valves, also double air valves, with road-surface boxes, for the corporation. —Mr. Frank Howarth, water engineer, Old Guildhall.

PLYMOUTH.—September 2nd.—For the supply of about 50 tons of pig lead, for the corporation.—Mr. Frank Howarth, water engineer, Old Guildhall.

PLYMOUTH.—September 2nd.—For the supply of about 4,400 tons of 33-in. cast-iron pipes and special castings, for the corporation.—Mr. Frank Howarth, water engineer, Old Guildhall.

LEWISHAM.—September 4th.—For the reinforcement with steel and concrete of a footbridge, for the borough council.—The Surveyor, Town Hall, Catford.

RICHMOND, N.S.W.—September 6th.—For the supply and erection of two units, each consisting of a centrifugal pump and electric motor, for the Metropolitan Board of Water Supply and Sewerage, Sydney. —Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Roads.

FAREHAM.—August 16th.—For the supply of granite, basalt, or other hard stone, for the rural district council.—Mr. J. F. Whitear, surveyor, Southampton-road, Fareham, Hants.

HARTLEY WINTNEY.—August 17th.—For the supply of steam road rollers, for the rural district council. —Mr. J. R. Listerson, surveyor, Fleet, Hants.

EPSOM.—August 23rd.—For the supply of 8,000 tons of broken granite, 500 tons of ¾-in. granite chippings, and 200 tons of ¼-in. granite chippings, for the rural district council.—Mr. T. E. Ware, surveyor, Waterloo-road, Epsom.

SANDGATE.—August 23rd.—For the supply of 600 tons of Guernsey, Leicester, or Cornish granite, or Cherbourg quartzite, evenly broken to 1½-in. or 2-in. gauge, and 100 tons of chippings evenly broken to ¾-in. or ½-in. gauge, for the urban district council.—The Surveyor.

GOSFORTH.—August 24th.—For making up part of a street and foot improvements, for the urban district council.—Mr. G. Nelson, engineer and surveyor, Council Chambers, High-street.

LAMBETH.—August 25th.—For the supply of Aberdeen granite paving setts, broken granite, broken flints, gravel, ballast, and tools, for the borough council.—Mr. H. Edwards, borough engineer, Town Hall, Brixton-hill, S.W.

EAST DEREHAM.—August 28th.—For the supply of 1,000 tons of granite, for the urban district council. Mr. F. L. Burch, surveyor, Council Offices.

DARTFORD.—August 30th.—For the supply of hard stone, and for steam rolling, for the rural district council.—Mr. J. Hockins, surveyor, Gartley, Dartford.

SOUTH MIMMS.—August 31st.—For the supply of 500 tons of Leicestershire or other broken granite, and 150 tons of chippings, for the rural district council. —Mr. J. Simcox, surveyor, Bearwood, Great Northroad, Potters Bar, Middlesex.

Sanitary.

BUNGAY.—August 16th.—For house scavenging, for the urban district council.—Mr. P. J. Sprake, clerk.

EARBY.—August 16th.—For the extension of sewage disposal works, for the urban district council. —Mr. J. E. Aldersley, engineer and surveyor, Council Offices.

ALFORD.—August 21st.—For the removal of nightsoil and refuse, for the urban district council.—Mr. T. N. Loy, clerk.

BEDWELLTY.—August 23rd.—For laying 9-in. sewers, for the urban district council.—Mr. D. H. Price, surveyor, Aberbargoed.

TENDRING.—August 23rd.—For scavenging work, for the rural district council.—Mr. A. J. H. Ward, clerk, 42 Church-street, Harwich.

QUEENSTOWN.—August 31st.—For works of drainage, for the General Hospital.—Mr. J. Aberne, surveyor.

Stores.

ROCHESTER.—August 31st.—For the supply of tools, horse hire, Portland cement, brooms, oils, road metal, and coal, for the corporation.—Mr. W. Banks, city surveyor, Guildhall.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance. ‡ Provisionally accepted.

COCKERMOUTH.—For taking down a chimney and removing the materials, for the rural district council.—Mr. J. B. Wilson.

W. E. Harrison, Sheffield	£18
H. Edgley, Bradford	15
E. Graham, Ellenborough, Maryport	8

GUILDFORD.—For the removal of old bridge and the construction of a new bridge, and the construction of a road, for the rural district council.—Mr. J. Anstee, engineer:—

Pirbright Bridge.

H. Lacy, Limited	£2,127
Munroe & Co.	1,443
C. F. West & Co.	1,382
W. E. Lester & Co.	1,375
Crosby & Co., Limited	1,299
Edwards & Co.	1,267
T. C. Turner	1,178
Municipal Contracting Company	1,026
G. H. Tucker	998

Engineer's estimate, £1,000.

Pirbright Camp-road.

A. G. Osenton	£1,699
Streeter & Co.	1,535
H. Williams	1,366
A. J. Bullen	1,299
Franks, Harris Brothers, Limited	1,293
T. C. Turner	1,287
E. & E. Isles	1,248
Willis & Powis	1,156
J. Ford	1,136

LEEDS.—For building boiler-house, chimney and boiler seating, and supplying and fixing Lancashire boiler, for the corporation.—Mr. W. T. Lancashire, city engineer:—

Cookridge-street Baths.

Boiler-house and Chimney.—W. Irwin & Co., Limited, Leeds, £1,131.

Lancashire Boiler.—J. Thompson, Wolverhampton, £534.

Painting Exterior of Kirkgate Market and Wholesale Fish Market.—R. W. Marshall, Leeds, £96.

Painting Exterior of New Market Hall Buildings.—C. Fenton & Son, Leeds, £150.

French Polishing to New Market Hall Buildings.—S. Hearfield, Leeds, £110.

Painting Property in Burmantoft-street.—Pitts & Payne, Leeds, £71.

Painting Leeds Bridge and Crown Point Bridge.—Dewey Brothers, Barton-on-Humber, £93.

Painting South Accommodation-road Bridge and Globe-road Bridge.—Dewey Brothers, Barton-on-Humber, £113.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

AUGUST.

21.—Institution of Municipal and County Engineers: Eastern Sub-district meeting at Cromer.

APPOINTMENTS OPEN.

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Sandgate Urban District Council.

Appointment of Working and General Foreman.

The above Council invite applications for the appointment of Working and General Road Foreman to act under the instructions of their Engineer and Surveyor.

Wages, 32s. 6d. per week, with overtime extra.

Applicants must be over military age.

Practical experience in, and control of workmen for, Scavenging, Watering, Road Making (Water-bound and Tar-macadam), Tar-painting, Paving, Construction and alterations to Water Supply Mains, Sewers, &c., is essential, and candidates must also be experienced in the organisation and supervision of manual and team labour.

Applicants must be able to keep Time-books and Materials and Stores Accounts.

Applications (in Candidate's own handwriting), stating age, experience, present and previous appointments, accompanied by copies only of three recent testimonials (which will not be returned), to be delivered to the undersigned, marked "Foreman" on the envelope, not later than the first post on Saturday, August 21st, 1915.

D. V. HOWARD,
Engineer and Surveyor.

Council Offices,
High-street,
Sandgate.
August 7, 1915. (2,669)

RECRUITS with sanitary knowledge required at once for the 2nd London Sanitary Company to form sanitary sections for the new Armies. Age 19 to 40. Pay and allowances of the Royal Army Medical Corps. Apply O.C., 2nd London Sanitary Company, Duke of York's Headquarters, Chelsea, S.W. (2,668)

COUNTY BOROUGH OF BLACKBURN.

APPOINTMENT OF BOROUGH SURVEYOR AND WATER ENGINEER.

The Corporation of Blackburn invite applications for the position of Borough Surveyor and Water Engineer, at a commencing salary of £800 per annum. The gentleman appointed will be required to devote the whole of his time to his duties, and will not be allowed to engage in private practice.

Canvassing, either directly or indirectly, will be regarded as a disqualification, but printed copies of testimonials may be forwarded to the members of the committee, a list of whom, together with the definition of duties applicable to the position, can be obtained on application to the undersigned.

Applications, stating age, qualifications, and experience, accompanied by copies of not more than three recent testimonials, and endorsed "Borough Surveyor and Water Engineer," to be sent to the undersigned not later than 12 o'clock noon on Saturday, the 4th day of September, 1915.

Original testimonials must not be sent, and, if sent, will not be returned.

(By order)

LEWIS BEARD,
Town Clerk.

Town Hall,
Blackburn.
August 5, 1915. (2,667)

BOROUGH OF BEDFORD.

APPOINTMENT OF MECHANICAL ENGINEER AND FOREMAN.

Applications are invited for the appointment of Mechanical Engineer and Foreman to take charge (under the direction of the Borough Engineer) of the Sewage Pumping Stations and Refuse Destructor.

Applicants should not be under 30 or over 40 years of age.

Candidates should be fully capable of managing sewage pumping machinery driven either by steam engines or electric motors, and be able to execute small repairs, and preference will be given to those who have had experience in similar work.

Wages will commence at £2 10s. per week, rising by four annual increments to a maximum of £3 per week, together with house, coal, rates, and light free. (A temporary bonus of 2s. 6d. per week will also be paid during the period of the War.)

Applications, in candidate's own handwriting, stating age, previous experience, together with copies of not more than three recent testimonials, to be sent to the undersigned not later than Tuesday, August 24th, 1915.

Canvassing is strictly prohibited, and will be deemed a disqualification.

N. GREENSHIELDS, A.M.I.C.E.,
Borough Engineer and Surveyor.

Town Hall, Bedford.
August 3, 1915. (2,662)

THE RURAL DISTRICT COUNCIL OF HALESOWEN.

APPOINTMENT OF SURVEYOR.

Applications are invited for the post of Surveyor for the Rural District of Halesowen, which comprises nine parishes.

There are about 26 miles of district roads to be superintended and maintained.

The Surveyor will be required to devote the whole of his time to the duties of his office, to provide himself with means of locomotion, and to reside in the district.

Candidates must be fully competent to perform the duties of the post, to prepare plans and specifications, to take levels, to keep in order the sewers, to superintend the making of house connections to sewers, to prepare Town Planning Schemes, to see that the by-laws of the Council are properly carried out, to keep the prescribed Accounts, and generally to comply with and carry out the instructions of the council.

The person appointed will be required to enter upon his duties as soon as possible, and to give approved security in the sum of £200 for the faithful discharge of those duties.

The salary will be £160 per annum, payable quarterly.

The appointment will be made subject to determination by three calendar months' notice in writing from either side.

Applications (marked "Surveyor"), in the candidate's own handwriting, stating age, qualifications, and previous experience, and accompanied by copies of three testimonials of recent date, must be received at the office of the undersigned not later than 12 o'clock noon on Monday, 23rd August.

Canvassing Members of the Council, either directly or indirectly, will disqualify a candidate.

(By order)

E. H. GROVE,
Clerk.

Church Steps House,
Halesowen.
August 3, 1915. (2,661)

COUNTY BOROUGH OF WEST HAM.

TRAMWAYS DEPARTMENT.

ASSISTANT CIVIL ENGINEER AND SURVEYING ASSISTANT.

The Council invite applications for the following positions on the staff of the Tramways Department:—

(*a*) Civil Engineering Assistant. Salary, £250 per annum.

(*b*) Surveying Assistant. Salary, £117-£120 per annum.

CIVIL ENGINEERING ASSISTANT:—

Applicants must be fully qualified civil engineers, with practical experience in the construction and maintenance of tramway permanent way, and be accustomed to the control and management of considerable numbers of men.

SURVEYING ASSISTANT:—

Applicants must be competent surveyors and levellers, quick, accurate and good draughtsmen. Experience in the preparation of plans, sections, and details in connection with tramway work an advantage.

Application must be made on the official form, which may be obtained from Mr. J. S. D. Moffet, General Manager, Tramway Offices, Greengate-street, Plaistow, E., and must be delivered at my Office not later than 12 noon on Saturday, 28th August, 1915.

GEO. E. HILLEARY,
Town Clerk.

Town Hall,
West Ham.
August 3, 1915. (2,664)

COUNTY BOROUGH OF WEST HAM.

TRAMWAYS DEPARTMENT.

GENERAL FOREMAN AND FOREMAN PLATELAYER.

The Council invite applications for the following positions on the staff of the Tramways Department:—

(*a*) General Permanent Way Foreman. Wages, £3 5s. per week.

(*b*) Foreman Platelayer. Wages, £2 5s. per week.

(*a*) Required, a General Permanent Way Foreman, thoroughly experienced in every branch of permanent way work and road construction, and capable of executing special work expeditiously and accurately. Applicants must have held a similar position, or had experience in a similar capacity, on engineering contracts of a corresponding nature.

(*b*) Required, a Foreman Platelayer, accustomed to the construction and lay-out of complicated junctions, curves, and other special tramway track work, and generally acquainted with modern practice in track construction and maintenance, including rail welding. Applicants must be capable of rapid and accurate work in the renewal of junctions, &c., and have had experience in the handling of temporary track. Only qualified platelayers need apply.

Application must be made on the official form, which may be obtained from Mr. J. S. D. Moffet, General Manager, Tramway Offices, Greengate-street, Plaistow, E., and must be delivered at my Office not later than 12 noon on Saturday, 28th August, 1915.

GEO. E. HILLEARY,
Town Clerk.

Town Hall,
West Ham.
August 3, 1915. (2,665)

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. AUGUST 20, 1915. No. 1,231.

Minutes of Proceedings.

Tar, Pitch and Bitumen.

A practical knowledge of the properties of tar, pitch and bitumen is essential to the modern road maker, and therefore the paper by Mr. A. Dryland, the county surveyor of Surrey, embodying his experience with these materials, which we reproduce this week, is valuable despite its brevity. Mr. Dryland thinks that coal tar has to a great extent been the salvation of our roads during the past few years, and when one considers what the dust nuisance and wear and tear would have been on main roads of ordinary macadam with the enormously increased use of motor vehicles, there can be no doubt that he is correct. He is of opinion that for surface treatment of water-bound roads a good quality water-freed tar serves all necessary purposes, and is superior in penetrating power to distilled tars. Most surveyors will agree to this, but it is probably for another reason than penetration that they prefer crude to distilled tar for painting. Distilled tar, being thicker and having greater viscosity, does not spread so freely as crude tar, and is apt to get laid too thick in some parts of the road, and consequently it works up in hot weather. Whether a distilled or a crude water-freed tar should be used for tar-macadam depends, in Mr. Dryland's opinion, upon whether it is to be used immediately or stored. Here again, however, other factors have to be taken into consideration, such as the season of the year and the convenience and cost of spreading. Tar macadam made from most crude tars is all the better for being stored or "hogged," especially in summer, so that the lighter oils may have some chance of evaporating during the period of hogging. With most distilled tars it is almost impossible to use tarred materials that have been hogged for any time in winter, as they are too stiff to be spread easily and economically. In summer nearly all kinds of tar-macadam are the better for being hogged for a month, but in cold weather, if the tar-macadam has been well mixed, it is better to lay it on the road while it is freshly mixed.

While many surveyors use pitch and creosote oil, others will use nothing but distilled tar for tar-macadam. This again is governed to a great extent by the season of the year, for with hot weather most distilled tars can be run freely from the tanks or barrels in which they are conveyed to the boiler; but in winter it is often necessary to apply heat to the tanks or barrels before they can be emptied. Many distilled tars are so robbed of the lighter oils that they are of a too "pitchy" nature, and tar-macadam made with such tars is likely to become brittle and quickly disintegrate. The tar for a coarse bottom coat can be made with a stiffer tar than the top coat, as it makes a stronger and less compressible foundation than one made with crude tar. So, again, the surface material of a road which is subject to heavy traffic and the direct rays of the sun for a great part of the day should not contain so much crude tar as that for a side street with little traffic or sun, as a road under heavy traffic and the influence of the sun, if made with crude tar, often "spews" or "bleeds" with unpleasant results. In these days of high speeds and heavy loads, a road too rich in tar, or containing too much of the lighter oils, as most crude tars do, becomes badly corrugated and very bumpy. Too much tar also leads to a soft surface, which requires much greater tractive effort than a road with less tar, and which has consequently a harder surface. The quantity of tar used is a very important factor in all kinds of tarred materials, and it is probably owing to the difficulty in gauging the proper amount required, quite as much as to the quality of the tar itself, that "tar" or "pitch" grouting has failed in so many places. As Mr. Dryland suggests, "the excess of matrix which is almost inherent in the system of grouting is a disadvantage."

While it appears to be impossible to specify a standard tar which can be used at all seasons and in all situations, there is no doubt that the standard specifications issued by the Road Board would, if carefully carried out, prevent so many failures being made. Many surveyors get excellent results by somewhat "rule of thumb" methods with the aid of experienced workmen, and on the other hand there are a surprisingly large number of failures with tars supplied as proprietary articles prepared by skilled analysts. The personal factor cannot be eliminated altogether, for machinery gives very erratic results at times. This accounts for so many surveyors preferring hand-mixed to machine-mixed tar-macadam. The tar for machine-mixed materials is generally, for ease in mixing and handling afterwards, made with a larger proportion of the lighter oils, and consequently it often works up after being laid on the road, and is lacking in viscosity. Mr. Dryland is of opinion that the cost of bitumen is too great to permit of its use except as a wearing surface, and that, while it should not be laid with a less thickness than 1 in., no great advantage is to be gained by any great increase of this thickness. He finds 12 to 15 per cent of granite chippings as much aggregate as it is desirable to use for carpeting, and he thinks that probably better results will be obtained without the admixture of any chippings. While he finds 1-in. carpeting is satisfactory on a good, sound base of water-bound macadam, he prefers two-coat work, composed of 2½ in. of tar-macadam for a base, with 1¼ in. of bitumen surfacing, as being more reliable.

Extra-Metropolitan Water Supplies.

Included in the introduction to the official return as to water undertakings in England and Wales, to which we referred last week, is a most interesting historical survey of the action which has been taken by the Government from time to time towards the control of water supplies outside the Metropolis. The honour of having been the first town to afford a municipal supply belongs apparently to Southampton, where the undertaking was established early in the fifteenth century. Many other towns followed suit, but it was not until 1840 that the water supply of large towns was made the subject of a general inquiry. It is not surprising that the Select Committee of that year reported that the provision of ample supplies of water within the reach and means of the poorer classes was of the utmost consequence, as in some places the existing supplies were lamentably deficient. In 1845 it could be said that public supplies in large towns were generally afforded by joint stock companies under powers conferred by special Acts of Parliament, but the difficulty, delay and expense of obtaining these Acts formed a great obstacle in procuring such supplies, especially in smaller towns. The laws in force and the usages then prevailing with regard to the supply of water in the great majority of towns and districts provided only for carrying mains through the principal streets, and failed in the important matter of carrying supplies into the habitations of the poorer consumers under an economical and properly regulated system. In consequence many people were obliged to carry their supply of water considerable distances at much inconvenience, labour, and expense. A large number of people in towns were unable to avail themselves of the piped services, and depended for their supplies upon wells, springs, ponds, rain water or adjacent streams—sources which were frequently liable to pollution.

In 1847 the Final Report of the Royal Commission on the Health of Towns was followed by the Towns Improvement Clauses Act, and legislation of a general character on the subject of water supply may be said to date from this year. The Waterworks Clauses Act was passed in 1847, but both of these Acts were limited in their application to towns or companies with local Acts incorporating their respective provisions. In 1848 a comprehensive Public Health Act was passed which, among other provisions, empowered the local boards of health which it set up to furnish proper and sufficient water supplies in their districts. This Act, however, only operated in those districts to which it was applied by the General Board of Health, and its results were not very encouraging. In 1866 a Royal Commission on Water Supply was appointed, but was concerned chiefly with the supply of the Metropolis, and it was succeeded by a Royal Sanitary Commission, which stated that the question of water supply involved more serious difficulties than any other subject referred to them. They recommended that extensive supervisory powers with regard to water supply should be given to the new Central Public Health Authority proposed by them (which was established as the Local Government Board in 1871); that the new statute which they advocated for the consolidation of the existing sanitary law (afterwards passed as the Public Health Act, 1872, which was repealed and re-enacted by the Public Health Act, 1875) should incorporate the main provisions of the Waterworks Clauses Acts, 1847 and 1863; that a new Waterworks Clauses Act should be passed comprising further provisions usually inserted in Water Acts; that powers should be given for the compulsory purchase of lands and water rights by Provisional Order; that further steps should be taken to secure the safety of reservoirs; that a central authority should be empowered to take legal proceedings against any purveyors of water who wilfully or negligently distribute polluted water; that every reasonable facility should be afforded for analysis of water; that a constant service should be insisted on as far as possible; and that houses in country districts should not be permitted to be occupied without some supply of wholesome water, or access to such a supply. The great Public Health Act of 1875 was followed by the Rivers Pollution Prevention Act of the next year, and other statutes dealing with matters of detail were subsequently passed. In the session of 1910 a Bill was introduced which proposed to restrict the powers of authorised water undertakers (1) by prohibiting the acquisition of fresh supplies without specific Parliamentary authority; (2) by rendering the undertakers liable to give compensation for injury to private supplies caused by their works; and (3) where water was taken from one district to supply another, by conferring on the local authorities of the districts from and through which the supply is taken the right to demand a supply from the works of the undertakers on terms to be agreed or fixed by the Local Government Board. This Bill was referred to a Select Committee, and as a result of their report no further action was taken, but later in the same year the return now under review was ordered by Parliament. We shall deal with the contents of the return itself next week.

* * *

Tiverton Councillors and the County Surveyor.

Responsible officials always present a big target for attack, and in the general way they rarely suffer injury from the onslaughts of the attackers. If the county surveyor of Devon wins through unscathed from the attentions he received recently at a meeting of the Tiverton Rural District Council this will not be the fault of certain members of that body, who certainly let themselves go in a fine, fire-eating frenzy of abuse. The question that gave rise to this tempestuous interlude was quite a prosaic one. It had reference to the building of a retaining wall to prevent flooding from the river Lowman and consequent injury to the main road at Huntsham. It had been the subject of a conference between the council's highway surveyor and the county surveyor, and the county surveyor had forwarded specifications which he desired should be followed in carrying out the work. Ostensibly there does not appear to be anything specially aggravating in this, but upon one rural councillor it acted after the fashion of a red rag upon a bull. It was a scandalous waste of money, he declared, to carry out the work as suggested by the county surveyor. "Owing to county officialdom," he added, "they were going to be put to enormous expense in the building of the wall." Another councillor, a reverend gentleman to wit, in the course of wider dialectical excursion, asked whether it was right that the whole of the main roads of the county should be in the hands of one man, with nobody over him except the Main Roads Committee, who only met a few times a year. Finally, yet another councillor declared it was a perfect scandal that an official should not approve of what the local authorities wanted. All this sort of criticism, while it is typical of what county (and other) surveyors have to put up with far too frequently, argues the lack of a sense of proportion among the councillor-critics. It is too obviously an instance of tearing a passion to tatters over a matter in which, as very frequently happens, the idea of efficiency affected by rural councillors does not square with the standard set by the skilled and experienced official. It is, of course, in the nature of things that people who talk as these gentlemen did should feel that they are dominated by an autocracy, though after all there are those who believe that a benevolent autocracy is sometimes both useful and necessary.

Oil-mixed Concrete. A Canadian contemporary mentions that while experimenting in an attempt to develop a non-absorbent, resilient and dustless road material, capable of withstanding the severe shearing and ravelling action of motor traffic, Mr. Logan Waller Page, director of the United States Office of Public Roads, discovered the waterproofing qualities of oil-mixed concrete. Extensive laboratory and service tests have definitely established the value of this oil-mixed concrete for damp-proof construction, and a new bulletin, No. 230, has been issued by the United States Department of Agriculture. This bulletin discusses fully the preparation and use of oil-mixed concrete. Briefly summarised, the conclusions to be drawn from them are that the admixture of certain mineral oils in small proportions, not to exceed 10 per cent of the cement used, does not lessen the tensile strength of mortar; that the decrease in the compressive strength of mortar and concrete is not serious; that concrete mixed with oil takes much longer to set hard, perhaps twice as long, but that the increase in strength is nearly as rapid in the oil-mixed material as in the plain concrete. The use of oil does not make the concrete impervious to heavy water pressure, but it does make it practically non-absorbent under low heads.

The value of oil-mixed concrete is said to be particularly great in the construction of basement floors and walls, watering troughs, cisterns, and in all parts of concrete structures that are to be made damp-proof. The oil should in no case exceed 10 per cent of the weight of the cement, and for the most part 5 per cent is all that is necessary. The sand and cement should be first mixed with the proper amount of water into a stiff mortar, to which is added the correct amount of oil, and the whole mass again thoroughly mixed until all traces of oil have disappeared. Particular care should be taken to ensure that the oil is thoroughly incorporated in the mixture, and the time of mixing should be practically double that when the oil is not used. The kind of oil is also important, and technical specifications are suggested in the bulletin in order to prevent the use of certain oils which might tend to impair the strength of the mortar or the concrete.

* * *

Municipal Employees and Recruiting. The response which has been made by municipal employees of all grades to the call for recruits has been on such a scale that in many districts some difficulty has been experienced in carrying on necessary public services with reasonable efficiency. Usually, however, in view of the urgent need of the country, the necessary sacrifices have been made, and a double burden has cheerfully been borne by those officials and workmen who remain. In some towns, however, the limit has been reached, and further men cannot be spared unless essential services—such as the collection and disposal of refuse—are to be curtailed. But what is an *essential* service? Judging by what transpired at a recent meeting, some members of the Halifax Town Council appear to think that the substitution of women for men as conductors on the tramcars would be so serious a matter that recruiting from the existing employees should be stopped in order to avoid it. The discussion arose upon a recommendation of the Finance Committee that, in view of the large number of employees of the corporation who have joined His Majesty's Forces, no officer or servant of the corporation who joined such Force after this date should, notwithstanding the resolution passed by the council in October, 1914, have the benefits referred to in such resolution, unless such officer or servant should have first obtained the consent to join of the chairman and the chief official of the corporation in the department in which he is engaged. Several members opposed the adoption of this recommendation on the ground that, if passed, it would discourage recruiting, and one member went so far as to say that it would be nothing short of hypocrisy to pass such a resolution and at the same time to continue to advocate recruiting. The question of the limit at which recruiting from any given industry should be discouraged or stopped is a difficult one, but perhaps on the whole it is as well that the Halifax Town Council rejected this recommendation of their Finance Committee.

* * *

The Remuneration of Architects. A curious situation is reported to have arisen in connection with an advertisement of the Kingstown Urban District Council inviting architects to submit their names for appointment in connection with a scheme of working-class dwellings. The remuneration offered was 2½ per cent upon the outlay, no payment whatever to be made in the event of the work being abandoned. The Royal Institute of British Architects asked the council to receive a deputation, who laid their views before the Housing Committee. The urban council subsequently revised their terms, offering 5 per cent upon the first house of a scheme and only 2 per cent upon the remainder, and promising very vaguely to consider a claim for money expended by the architect should the scheme be abandoned. The institute thereupon asked its members not to apply for the position, or if application had already been made to withdraw it. Nevertheless, at a recent meeting of the council it was announced that eleven Irish and eight English applications had been received. At the meeting of the council it was argued that there had been a technical error in connection with the appointment by reason of the terms having been decided by the committee and not by the council. It was therefore decided to adjourn the appointment.

* * *

War Work for Professional Men. Professional men who have practical experience in various branches and grades of the engineering trades, and are anxious at the present time to place their services at the disposal of the Government, are invited to consider the possibility of undertaking manual work in connection with the production of munitions of war. The great need of the moment is for skilled mechanics (turners, fitters, millwrights, &c.), but it is stated in an official notification issued on Tuesday that men whose training has included engineering workshop experience can now do valuable service by offering to do manual work at the usual rates of payment for such work. They will not displace any skilled workman who is already employed or is capable of being employed upon the production of munitions. They will simply increase the army of those who by work at home help the armies abroad. Professional men who wish to offer their services to this end should send full particulars of their qualifications to the "Engineers' War Service Register," Queen Anne's-chambers, Westminster, S.W.

Leakage from Water Mains.—A paper read before an American waterworks association contains a reference to very complete and thorough tests, extending over a period of seven or eight years, which have been made in the city of Washington in connection with the problem of water waste. The data on underground leakage are so itemised as to indicate exactly the amount of loss from the different sources, and the tabulation shows the two principal sources of leakage to be from iron services and joints on mains. The former comprises approximately 29 per cent of the total loss, and the two combined represent one half of the entire leakage.

Tar, Pitch and Bitumen in Road Construction.*

By A. DRYLAND, M.Inst.C.E., County Surveyor, Surrey.

At the present day one of the responsibilities which falls upon the road engineer, whether in a large or small district, is the decision as to what treatment, under the particular circumstances of each separate road, it is wise and economical to adopt, bearing in mind, firstly, the most important consideration—viz., how to satisfactorily carry the traffic—and, secondly, how this can be done in the most economical way, both in first cost and subsequent maintenance.

The author would like to emphasise the point that it is the particular circumstances of the road which have to be considered, including the kind and quantity of traffic, the subsoil and drainage, exposure to weather conditions, and the thickness and nature of its crust. There is no one road for all conditions, and the road engineer will best fulfil his functions who is able to select and carry out the best form of treatment for the particular conditions he has to meet.

It is more with a view of eliciting a discussion which will help in the formation of a proper judgment on these matters that the author ventures to put forward some views on the use and situations for the three materials forming the subject of this paper than with any desire to suggest any authoritative dicta.

COAL TAR.

This most useful material, the author thinks, has been to a great extent the salvation of our roads during the past few years, and still has a great part to play. In the surface treatment of roads it has largely eliminated the dust trouble, and has further largely increased the durability of water-bound macadam, while in the production of tar-macadam it has been a necessary ingredient in the manufacture of a material that has produced excellent road surfaces for all but the very heaviest traffic. A point which is well worth discussion by the institution is the kind of tar which should be used in particular circumstances, and for the purposes of eliciting such discussion the author unhesitatingly puts forward the view that for surface treatment of water-bound roads a good quality water-freed crude tar serves every necessary purpose, and in its penetrative power is superior to distilled tars. It should be said, however, that its use should be avoided where from any cause—such as the vicinity of fishing streams, ponds or watercourses readily reached by tar washings—it may involve risk. Whether a distilled tar or a water-freed tar only should be used in the production of tar-macadam depends, in the author's opinion, as to whether it is to be immediately used or stored.

COAL-TAR PITCH.

During the last few years a good deal of this material has been used fluxed with heavy oils of tar for the purpose of grouting macadam. The author has executed a good deal of this work, and has seen large areas of it in other counties, and has formed the opinion that it is an unsuitable material for surface work, chiefly owing to its susceptibility to heat, which permits of such movement of the material in hot weather as to destroy the evenness of surface which is so desirable in a road, and, moreover, impairs its waterproofness to such a material extent that winter conditions act most unfavourably upon it. Its softness in summer is in great contrast to its extreme hardness in winter (where it remains waterproof), and the author has had more complaints of slipperiness than on any other kind of surface he has laid. The author further puts forward the view—again with the hope of eliciting discussion—that the method of pitch-grouting as now practised is a crude and unsuitable way of using the material, inasmuch as far too great a quantity of the matrix is so used. The author contends that if pitch and oil are to be successfully used as binding ingredients they should be used with properly dried and heated stone in a suitable mixer, where the quantity of matrix can be properly regulated, and the minimum quantity used to coat the stone. It will be found by this method the matrix used can be reduced by nearly 50 per cent. In the author's view it is largely the great quantity of matrix used in the grouting method, without any certainty of the regular and proper coating of the stone, which has led to the unsatisfactory results on heavily trafficked roads which the author has found in so many cases, and not least in his own experience. In the author's opinion a well-regulated pitch and oil mixture properly applied to thoroughly dry and heated stone forms a very strong macadam, but he would prefer to use it as a strength coat or base for material less susceptible to sun heat.

The author knows of cases in towns—where the traffic is necessarily slow, and where there is less exposure to the sun, and facilities exist, such as prompt "chipping" or watering, for mitigating the effects of heat—where considerable success has been achieved by the grouting method; but here again one comes to particular circumstances. While, therefore, the author would assert that it is not a satisfactory method for exposed country roads subjected to heavy and fast traffic, he is not prepared to say that its use should be abandoned where the local conditions permit of success; but even in these cases the author would suggest that the excess of matrix which is almost inherent in the system of grouting is a disadvantage.

BITUMEN.

The author does not propose to tread the thorny path of discussing what is or what is not bitumen, but will in this paper be understood to refer to either natural bitumens derived from deposits or bituminous residuals from the distillation of mineral oils. All the author would desire to say as a word of advice to those who are making their first venture is to be careful in their selection of the material they use, and, if possible, to obtain not only inspections under different weather conditions of the material as laid, but reliable information as to the time at which it was laid, the subsequent repairs, the nature of the base, and the traffic to which it is subjected.

Another point the author would like to emphasise is the absolute necessity of a sound base. No success can be possible unless the substratum is absolutely sound.

With regard to the use of bitumen, its first cost and expense of manufacture is, in the author's opinion, too great to permit of its use except as a wearing surface, and, provided it is laid on a thoroughly firm base with a satisfactory key, the author puts forward the view that, while an inch is probably nearly the minimum thickness at which it can be laid to give an extended life, no great advantage will be gained by any considerable increase beyond that thickness.

A most important point for consideration in the use of bitumen is the aggregate with which it is to be incorporated which will govern to a great extent the proportion of the matrix. The bulk of the aggregate will generally consist of a silica sand, and it is important that it shall be of perfectly clean crystals not too rounded in shape, with a satisfactory grading. A fine filler is also a necessary ingredient, and this is one of the points in connection with the manufacture of bituminous surfaces in which there is some variety of opinion. What may be termed the standard filler is Portland cement, but as this is expensive, and, as far as can be judged, its hydraulic properties can be of no useful service, the author sees no reason why some cheaper material of approximately equal specific gravity and fineness should not be substituted. Another point as to which there is a difference in opinion and practice is the use of a proportion of coarse-grade particles, such as granite chippings, in bituminous carpets, and the proportion which may be incorporated in the bulk. The author has sections of road containing from 10 per cent to as much as 60 per cent of granite chippings, but is inclined to the view—on which he will be able to give a more reliable opinion at a later date—that a much less proportion—probably from 12 to 15 per cent—is quite as much as it is desirable to use. It is quite probable that better results will be obtained without any admixture of chippings. The author is experimenting in these directions, and when sufficient time has elapsed hopes to be in a position to furnish the institution with the results of his observations.

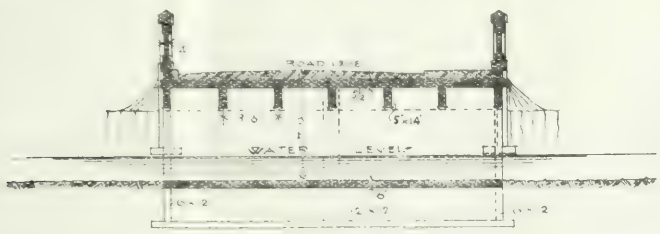
Assuming a suitable aggregate and bitumen has been found, the manufacture and laying of the material need the utmost care to get the best results. The aggregate must not only be raised to the requisite temperature, but care must be taken to see that it

* Paper presented at the annual meeting of the Institution of Municipal and County Engineers.

has been thoroughly dried, as it is possible to have sufficient heat without extracting the moisture. Efficient drying and mixing plant is therefore essential, also the utmost care in every detail of the admixture of the ingredients, with frequent tests of the material to see that no substantial variation takes place from the standard set up.

Having referred to some of the questions upon which the practice in manufacture of bituminous work in this country may be said to be somewhat in a state of flux, and with the main considerations in the production of a suitable material, the author will endeavour to suggest the conditions in which he thinks this material may be most serviceable under existing conditions, and with our present state of knowledge. The author places this material between the most durable tar-macadams and wood or granite-sett pavings, and therefore advocates its use where the traffic conditions are too severe for the former, but do not justify the large capital outlay for either of the two latter pavings. The author has for long been tempted to suggest some standard of traffic as a dividing line between these various forms of surfacing, but the varying effect arising from the different kinds, weights and speeds of vehicles, together with the physical features of the road, would, he fears, make such a standard misleading, and he has come to the conclusion that it is a subject for individual judgment in each case after observation of all the conditions prevailing.

On the debatable question of "carpet" or "two-coat" work further experience is necessary before attempting to rule out the former method, although the author's predilection is in favour of the latter as offering a more sure basis for satisfactory results. The author has had the most excellent results from bituminous carpets, 1 in. only in thickness, on a water-bound macadam base, where such base has been absolutely sound, but where this latter condition has not prevailed the repairs have been very considerable. In embarking on a scheme last year for the resurfacing of some 25 miles of road with bituminous wearing surface the author decided to adopt the "two-coat" method, and is forming the base coat, 2½ in. in consolidated thickness, of scarified material with a pitch and oil matrix, and laying thereon a 1¼-in. bitumen surfacing, all being laterally supported by a 9-in. by 4-in. reinforced in situ concrete submerged kerb. The work is being carried out under the author's direction with plant purchased for the purpose, and the work is now in progress between Croydon and Merstham on the London and Brighton road. Members of the institution are welcome to visit the plant and the work, and the author will be happy to give information with regard to details. The works were started last September, and the author had hoped to be able to furnish the institution this year with a paper containing in considerable detail facts and figures; but the progress of the work has been so hampered by a variety of conditions, mostly arising out of the war, that the author feels the figures would be so far removed from the normal as to be of no great value, and has therefore thought it better to await further experience under what he hopes may prove happier conditions.



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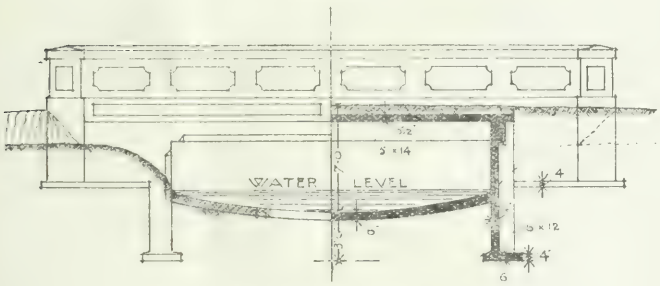


Half-elevation and Section.

Bridge over River Brain, Witham, Essex

AN ESSEX RIVER BRIDGE.

The river Brain, which passes through the ancient Essex town of Witham, is a small stream formerly spanned by a very old timber bridge whose origin was involved in some obscurity, while the structure itself had become so insecure that all heavy traffic had to make a long detour to avoid the risk of causing failure. The limited utility of the old bridge was clearly indicated by the notice "Carts must not pass over this bridge," and it is therefore evident that the urban district council were fully justified in replacing it by the Mouchel-Hennebique structure of which some particulars are given in the present article, which appeared in the July issue of *Ferro-Concrete*.

Although of small dimensions and simple design, the bridge may be cited as one further illustration of the special adaptability of ferro-concrete for the economical construction of small bridges in country districts, where the provision of funds for bridge building and maintenance is always a matter of importance to local authorities.

The new bridge was designed by Mr. W. P. Perkins, A.R.SAN.I., the surveyor to the urban district council, for whom working drawings were prepared by Messrs. L. G. Mouchel & Partners, of Westminster, the contractors being Messrs. McLaughlin & Harvey, Limited, of London.

On Saturday, March 27th last, the bridge was officially tested in the presence of Mr. J. E. Smith, chairman of the Road Committee of the Witham Urban District Council, Captain Abrey, member of the Road Committee, Mr. W. P. Perkins, A.R.SAN.I., surveyor to the council, and Mr. W. R. Howard, of Messrs. L. G. Mouchel & Partners.

The maximum deflection allowable was 1/600th of the span, equivalent to, say, 10 mm., whereas the maximum deflection recorded was only 1·6 mm., say 1/3800th of the span, which was considered by all present to be a most satisfactory result, demonstrating the large factor of safety provided for in the design.

Municipal Economy.—Huddersfield Town Council propose to appoint a "Savings Committee," to report as to how economies can be effected in the several departments of the corporation without impairing working efficiency.

Electrical Undertakings.—In cases where extensions of electricity undertakings are imperative for the supply of power to firms engaged on war work the Treasury has arranged with the London County Council to abandon many of the usual preliminaries so that the council can grant loans without delay, but only provided that the extensions are necessary to meet the requirements of firms engaged on work direct for the War Office or the Admiralty.

Water Undertakings of England and Wales.

THE NEW GOVERNMENT RETURN (2).

In the recently issued Blue-book on the water undertakings of England and Wales particulars are given of the undertakings of 786 separate local authorities, the Metropolitan Water Board, and 34 other joint authorities, 200 companies with statutory powers, 84 private companies, and 1,055 private proprietors.

LOCAL AUTHORITIES' UNDERTAKINGS.

Of the 786 local authorities with separate undertakings, 51 are county borough councils, 151 councils of non-county boroughs, 298 urban district councils, and 286 rural district councils. Two authorities—the town councils of Burton-on-Trent and Norwich—which do not supply water within their own areas, but supply a few houses outside their districts in connection with their sewage disposal works, are not included in these figures. In some cases the undertaking of the local authority supplies only a part of their district; in the case of most of the rural districts a supply is furnished in one or two parishes only. Some rural district councils supply different parts of their districts from different sources, but these have not been counted as separate undertakings.

Some of the largest water undertakings in the country are owned by local authorities. The importance of the undertaking of Manchester Town Council can be appreciated from the fact that the average daily quantity of water supplied is 44,000,000 gallons, of which nearly 18,000,000 gallons are obtained from Lake Thirlmere, 96 miles distant. Liverpool and Birmingham also obtain water from very distant sources, and supply respectively 34,462,000 gallons and 21,705,000 gallons a day. Leeds, Bradford, Sheffield, and Kingston-upon-Hull each supply more than 12,000,000 gallons per day; 11 other local authorities supply between 5,000,000 and 12,000,000 gallons, 65 others between 1,000,000 and 5,000,000 gallons, and 47 between 500,000 and 1,000,000 gallons a day, making a total of 130 local authorities supplying over 500,000 gallons a day.

Five hundred and forty-seven of the local authorities which possess separate water undertakings supply under the authority of the Public Health Act, while the remaining 239 have special Acts. Of the latter 145 have districts or parts of districts other than their own within their statutory limits of supply. The following table shows the number of authorities of each class with special Acts, and the number which supply water in other districts, both within and without their statutory limits, either direct to the consumers or in bulk to other authorities:—

Councils of	Number of authorities with special Acts.	Number of these authorities supplying			
		Direct to consumers in other districts		In bulk to other authorities.	
		Within limits.	Without limits.	Within limits.	Without limits
County boroughs ..	51	13	23	18	28
Non-county boroughs	72	12	19	12	15
Urban districts ...	111	19	23	11	24
Rural districts ...	5	—	—	—	1

The majority of local authorities maintaining waterworks under the Public Health Act confine their operations to their own districts, but the board have sanctioned the supply of water to adjoining districts by 106 local authorities under sec. 61 of the Public Health Act, 1875.

JOINT AUTHORITIES.

The joint authorities are generally composed of representatives of local authorities combined for the purpose of supplying water to the districts of the authorities represented, but county councils and other public bodies are also represented on the Metropolitan Water Board and the Derwent Valley Water Board. The local authorities represented on joint boards and joint committees for supplying water are the councils of the 29 metropolitan boroughs, 10 county boroughs, 23 other boroughs, 78 urban districts, and 25 rural districts. Apart from the Metropolitan Water Board, the largest joint undertakings are the Tees Valley Water Board, which distributes 15,000,000 gallons daily, and the Derwent Valley Water Board, which supplies just over 10,000,000 gallons daily in bulk to its constituent authorities for distribution by them.

Besides the three boards mentioned there are 14 other joint authorities each of which supplies over 500,000 gallons daily. Generally speaking, the most important of the joint authorities have been constituted under special Acts of Parliament or Provisional Orders under sec. 279 of the Public Health Act, 1875; in the other cases they have been formed by agreement under the Public Health Act, 1875, or the Local Government Act, 1894.

COMPANIES WITH STATUTORY POWERS.

The 200 companies with statutory powers comprise 152 which possess special Acts and 48 whose powers are derived from Provisional Orders issued by the Board of Trade under the Gas and Water Works Facilities Acts. The last-mentioned companies are generally of minor importance. The South Staffordshire Waterworks Company, supplying 16,690,793 gallons per day, has the fifth largest undertaking in England and Wales. The next largest companies and their daily supplies are Bristol Waterworks Company, 10,278,000 gallons; Newcastle and Gateshead Water Company, 8,962,000 gallons; Sunderland and South Shields Water Company, 8,520,000 gallons; the Borough of Portsmouth Waterworks Company, 8,261,000 gallons; and Staffordshire Potteries Waterworks Company, 7,625,000 gallons. Altogether there are 66 companies, each of which supplies over 500,000 gallons of water daily.

Three companies merely distribute water purchased in bulk from other undertakers, while two others did not, at the date of the return, furnish any supplies.

COMPANIES WITHOUT STATUTORY POWERS.

These 84 companies are all of minor importance. The largest supplies known to be distributed by any of them are furnished by the Hetton-le-Hole and Easington Lane Water Company, and by the Whitstable Water Company, which each supply 170,000 gallons per day; the Combe Down, Bath and General Waterworks Company comes next with 118,000 gallons per day. In many cases the quantity of water supplied is not known. Nine of the companies merely distribute water obtained in bulk from other undertakings. No less than 24 of the private companies are in the West Riding of Yorkshire, 13 being within the rural district of Skipton.

PRIVATE PROPRIETORS.

The 1,055 undertakings of private proprietors are generally very small, and, as a rule, afford supplies only to the property of the proprietors. Particulars of the waterworks of parish councils, voluntary committees, and other undertakings of a private nature are also included in this section. Only 11 private undertakings possess powers under special Acts or Orders, the most important being that of the Marquess of Exeter, which supplies 171,000 gallons per day, chiefly in the borough of Stamford.

PROGRESS OF THE PROVISION OF PIPED SUPPLIES.

The return shows that of the 1,130 boroughs and other urban districts outside London included in the return there were only 29 without a piped supply to a part at least of the district, and these were very small places. Five hundred urban district councils controlled the water supply of their districts or of a part of their districts as a separate undertaking, and 111 as constituents of a joint board or committee. Many of the urban district councils with separate undertakings furnished a supply in other urban districts, and altogether 822 of the 1,101 urban districts with piped services were supplied municipally. In 309 urban districts or parts of urban districts water was supplied by companies and in 85 by private proprietors. Several urban districts obtain supplies from more than one undertaking.

The provision of piped supplies in rural districts has naturally not kept pace with the supply to towns, but in 1914 out of the 12,869 parishes in rural dis-

tricts 1,874 had a piped supply to some at least of their houses.

Of the 97 towns with a population over 50,000 at the census of 1911 the following 26 were in 1914 supplied wholly or in part with water by a company: Birkenhead, Bournemouth, Bristol, Burton-upon-Trent, Cambridge, Chester, Dudley, Eastbourne, Gateshead, Gillingham, Great Grimsby, Great Yarmouth, Ilford, Luton, Newcastle-on-Tyne, Norwich, Portsmouth, Southampton, Southend-on-Sea, South Shields, Stoke-on-Trent, Sunderland, Walsall, West Bromwich, West Hartlepool, York.

It is not possible to say what portion of the country is supplied municipally and what portion by companies, chiefly because some districts are supplied by more than one undertaker. Birkenhead, for instance, is supplied partly by the town council and partly by the Wirral Company. And in some cases local authorities distribute supplies obtained in bulk from companies and *vice versâ*. The North Cheshire Company supply Altrincham and other districts with water obtained from Manchester Corporation, while Crewe Town Council distribute a supply provided by the London and North-Western Railway Company. From the particulars given in this paragraph it seems likely that about two-thirds of the total population of the country is now supplied with water by municipal bodies, and that only a few million of the inhabitants of England and Wales depend on unpiped supplies.

SUPERSESSION OF WATER COMPANIES BY LOCAL AUTHORITIES.

Not only has the provision of a piped supply of water been undertaken by the local authority in many districts which depended on private supplies, but water companies providing a piped service have in a large number of cases been superseded by local authorities.

Sec. 63 of the Public Health Act, 1875, enables a water company to sell or transfer its undertaking to a local authority by agreement. Apart from this provision, which has not been extensively used, about 100 special Acts have been passed since 1876 giving power to local authorities in England and Wales to purchase the undertakings of water companies supplying their districts, and in a great majority of cases these powers have been exercised. On the other hand, in a very few instances small water undertakings of local authorities have been transferred under Parliamentary sanction to water companies.

The practice of Parliament in giving powers for the compulsory purchase by local authorities of water undertakings belonging to companies has varied with the circumstances of the case. Where companies have come to Parliament for powers or for further powers the local authorities concerned have frequently opposed the Bill in Parliament in order to obtain a clause authorising them to purchase the undertaking and requiring the company to sell on certain terms. In other cases local authorities that have desired to purchase the undertaking of a statutory company have themselves introduced a Bill for this purpose, often simultaneously with a Bill introduced by the company to obtain further powers. The principles on which Parliament has generally acted in giving these powers are illustrated by the decision of the House of Lords Committee on the Bill promoted in 1887 by the Sheffield Town Council. The chairman stated:—

> "The Water Committee have come to a decision that it is expedient that the works of the Sheffield Water Company and the control of the water supply should be transferred to the corporation. They have come to this conclusion on the grounds of public policy. But they do not consider that there has been any proof of mismanagement or failure of duty on the part of the company; and consequently they think the terms of purchase should be not only fair but liberal."

On the motion for the third reading of the Bill an amendment was moved that the Bill be read a third time that day six months, on the ground that the company had not failed in their duty, and that if such transfers ought to be authorised as matters of public policy the Government should undertake public general legislation on the subject, but after a discussion the amendment was withdrawn.

Parliament, however, has not always acted on this principle. Eastbourne and Southampton in 1897, Hartlepool and Norwich in 1898, Hartlepool again in 1901, and Cambridge in 1911, are among the larger local authorities which have made unsuccessful attempts to obtain from Parliament powers to supersede water companies. In 1909 the Glamorgan County Council promoted a Bill with the object of forming a large water board to acquire the undertakings of certain water companies and local authorities. The preamble was declared proved by the House of Commons Committee, but the Bill was rejected by the Committee of the House of Lords.

Where a local authority whose limits of supply include the district of another local authority comes to Parliament for further powers, Parliament has in a number of cases inserted a provision in the Bill to empower the local authority of the outside district to purchase the portion of the undertaking which is within their district.

LIMITATION OF POWER OF LOCAL AUTHORITIES.

The effect of the restriction in sec. 52 of the Public Health Act, 1875, on the powers of a local authority to supply its district with water is to give a monopoly to a company or local authority with special powers (which for this purpose is deemed to be a company) in whose limits the district is included by the special Act. The undertakers usually profess themselves able and willing to furnish a supply on terms, and the only terms on which they are under an obligation to supply are those of sec. 35 of the Waterworks Clauses Act, 1847, which is, as a rule, incorporated with the special Act. This section provides in effect that the undertakers shall supply any part of their limits if 10 per cent of the expense of laying down the necessary pipes is guaranteed to them for three successive years at least. In some places within the limits, but at a considerable distance from the works and mains of the undertakers, these terms have been found prohibitive, and although it has been ascertained that a supply could be obtained at much less cost from another source, the undertakers have insisted on their right to supply on the basis of the 10 per cent guarantee, and have refused to allow the more economical scheme to proceed. The Select Committee on the Public Health Act (1875) Amendment Bill, 1878, drew attention to the defects of this section, and recommended that where a district within the limits of a company was unsupplied, the local authority should be empowered to require them either to allow the local authority to supply, to supply the district themselves, or to supply water in bulk to the local authority for distribution. This recommendation, which has not been adopted, does not meet the difficulty of the terms on which the company are able and willing to supply. A clause, known as a "re-entry" clause, inserted in some local Acts enacts that if the undertakers are not furnishing or prepared on demand to furnish a sufficient supply of water throughout the district of any local authority within the limits of supply within a specified number of years, the local authority may provide such supply in accordance with the Public Health Act, 1875. This clause, however, has not been found useful in practice, since the undertakers will generally profess themselves prepared on demand to furnish a sufficient supply on the terms authorised by the Waterworks Clauses Act.

POWERS.

Common Law.—In England and Wales under the common law every landowner has the right to use water flowing in known or defined channels—*i.e.*, the water naturally flowing through, past, or under his land, both for his domestic use and for his cattle, without regard to the effect of such use upon the landowners lower down the stream. Further, he has the right to use the water for any purpose, provided there is no interference with the rights of other landowners either above or below. He cannot, however, lawfully abstract from any stream water for sale or for the supply of the inhabitants of any neighbouring area. As regards underground water not flowing in defined channels, every landowner has the exclusive right to all water obtainable from his land.

The case of *Chasemore* v. *Richards*, decided in 1859, confirmed by subsequent cases, of which the best known is *Bradford Corporation* v. *Pickles* (1895), establishes the doctrine that water percolating under the surface of the ground belongs to the man who can catch it first, and that there is no remedy in law against the owner of a well which intercepts water which formerly flowed into a stream or another well.

From early times many villages and small towns were provided with water by local landowners, and later also by private associations and by companies

without statutory powers. The proprietors of these undertakings could only afford piped supplies to consumers by agreement, and with the consent of the road authorities and inhabitants.

Charters, Warrants, and Special Acts.—Powers to construct waterworks were granted in early times by means of charters, and it was under such authority that some municipalities had established waterworks before 1800. Some of the early undertakings also derived some of their powers from Royal Warrants, but the chief authority for water undertakings before the middle of the nineteenth century was a private Act of Parliament. The first Act of this kind was that passed in 1541, which gave power to the Mayor and Dean of Gloucester to supply water. Many of the supplies furnished in early times in the Metropolis were given on the authority of local Acts, and in several provincial towns the municipal authorities, or more commonly a company, obtained Parliamentary powers to supply water before the middle of the nineteenth century.

In spite of the general legislation of 1848 to 1878, the practice of obtaining special Acts with regard to water supply has continued, and the number of special Acts in force is very large; 239 local authorities and 152 statutory companies now possess local Acts relating to water undertakings. In a few cases one local Act only regulates an undertaking, but in the great majority of cases in which recourse is had to local legislation more than one Act is in force, and, in the case of local authorities, Provisional Orders amending local Acts have often been obtained. In some instances 10 or more local Acts and Orders apply to the same undertaking. The eight metropolitan water companies which were absorbed by the Metropolitan Water Board in 1902 had 80 unrepealed local Acts in force, and these still apply in part to the undertaking of the Water Board.

Provisional Orders altering or amending local authorities' Acts may be made by the Local Government Board under sec. 303 of the Public Health Act, 1875. The board have made many Provisional Orders under this section empowering local authorities to construct or extend waterworks (where the powers sought do not involve the giving of compulsory powers of acquiring lands or water rights), conferring additional borrowing powers on local authorities for the purposes of their water undertakings, and making other provisions in regard to the supply of water by local authorities too numerous to mention in detail. Public notice has to be given of any proposed Order, and a local inquiry is held at which persons interested have a right to attend and make objections, and the board, before making the order, must consider any objections which have been made. The Order, before becoming law, has to be confirmed by Parliament.

General Acts of Parliament.—The first general legislation on the subject of water supply was contained in the Towns Improvement Clauses Act, 1847, and the Waterworks Clauses Act, 1847. The Public Health Act, 1848, was the first general Act which enabled local authorities, under certain conditions, to provide their districts with water; but this, and the later Acts which extended its powers, only applied to districts in which they were put in force by the machinery provided by the Acts. The Public Health Act, 1872, divided the whole of England and Wales into sanitary districts, and by the Public Health Act, 1875, which repealed the Act of 1872, the general powers already conferred upon certain local authorities by the earlier Acts were consolidated and extended to every sanitary authority.

This Act and the Public Health (Water) Act, 1878, are the chief general statutes which now regulate the supply of water by local authorities in England and Wales outside the Metropolis. The Act of 1878 applies only to rural district councils, but urban authorities may be invested with all or any of its powers by the Local Government Board.

As regards companies, the Gas and Water Works Facilities Acts, 1870 and 1873, provide machinery whereby powers for supplying water may be conferred by Provisional Order of the Board of Trade, which has to be confirmed by Parliament. The Acts themselves do not confer any powers to supply water.

Insufficiency of the General Law.—In consequence of limitations upon the powers which may be obtained by undertakers by means of Provisional Orders under the Gas and Water Works Facilities Acts and sec. 303 of the Public Health Act, 1875, and as the general powers given by the Public Health Act are insufficient in some cases to enable local authorities to undertake the schemes necessary for supplying their districts with water and to carry on their undertakings in accordance with their requirements, it is frequently necessary for both companies and local authorities to have recourse to local Acts.

The cost of obtaining a local Act is often considerable, even where the Bill is not seriously opposed, and much in excess of the cost of proceeding under the general law. The cost of a Provisional Order under the Public Health Act, or of proceedings under the provisions of that Act relating to water supply, is usually trifling, being limited, in most cases, to the expenses attendant upon the local inquiry which is held by the Local Government Board into the application for the Provisional Order or for the loan for the carrying out of the works of water supply, as the case may be. Of course, if a Provisional Order had to be supported against opposition in Parliament, the cost might approach much more nearly to that of a local Act.

The fact that all the county boroughs with water undertakings (51) have obtained local Acts affords evidence that the powers of the Public Health Act in this matter have not sufficed—at any rate for the larger schemes.

Acquisition of Water Rights.—One of the chief reasons why recourse is had both by companies and local authorities to special legislation on the subject of water supply is the difficulty which is experienced in acquiring water rights—*i.e.*, the right to take water from any river or stream or from any watercourse flowing in a known or defined channel. For a short time it was thought that water rights could be taken compulsorily by means of Provisional Orders made under sec. 176 of the Public Health Act, 1875, and several Orders were made accordingly; but in 1877 a Select Committee of the House of Lords decided that such a Provisional Order was *ultra vires*, and the Law Officers of the Crown advised that, in view of the protective provisions contained in the Act, and particularly secs. 327 and 332, this view was correct. The Select Committee on the Public Health Act (1875) Amendment Bill of 1878 stated that this decision would produce serious inconvenience to sanitary authorities, and would necessitate agreements with every riparian owner, lessee, and occupier below a proposed intake. The committee therefore recommended that the Local Government Board should be empowered to issue Provisional Orders enabling local authorities to purchase water rights compulsorily, and though this recommendation was repeated by the Select Committee on the Water Supplies Protection Bill, 1910, and though legislation has been introduced on several occasions to carry it out, nothing has so far been effected. At present, under the general law, water rights can only be obtained by agreement with the riparian owners, and in many cases these owners have proved obstructive. In one case one riparian owner out of twenty-five successfully prevented a rural district council from providing a much-needed supply. As rural district councils have no express statutory power to expend money out of the rates on the promotion of Bills in Parliament (though five have, in exceptional circumstances, obtained local Acts with regard to water supply), schemes of water supply in rural districts have been abandoned owing to the impossibility of obtaining water rights. It may be observed that the Public Health (Ireland) Act, 1878, empowers the Irish Local Government Board to make Provisional Orders for the compulsory acquisition of water rights.

Borrowing Powers.—With regard to local authorities, a further reason for recourse to local legislation may be found in the restriction placed by the latter Act on the borrowing powers of the local authority. Most local Acts contain a provision that loans borrowed under the local Act are not to be taken into account in determining the borrowing power of the local authority under the Public Health Acts, and the borrowing power of the local authority is therefore increased by the full amounts authorised to be borrowed by its local Acts.

Limits of Supply.

The Public Health Act, 1875, empowers each local authority to supply water within its own district, except where an undertaker already possesses statutory powers to supply. A local authority supplying its own district under this Act may, with the sanction of the Local Government Board, supply the authority of any adjoining district.

Undertakers having powers under special Acts or orders invariably possess areas or limits defined by

the Acts or orders within which they are authorised to supply water. In the earlier Acts the limits are very variously defined, and usually the exact boundaries can only be ascertained by reference to deposited maps. The vague descriptions of the original limits, combined with subsequent changes of administrative areas, make it impossible to ascertain exactly the present limits of supply. In later Acts the limits are usually defined by reference to civil parishes, [illegible] In the present return the limits have been described in terms of boroughs, urban districts, and parishes in rural districts.

The following table shows the total number of districts and parishes in England and Wales, and the number wholly or partly within the limits prescribed in special Acts.

	Number of districts and parishes.	
	Total.	Within limits prescribed in special Acts.
Boroughs and urban districts	1,130	739
Parishes in rural districts	12,807	2,879

Of the 290 local authorities with special Acts or orders, 145 have districts other than their own within their statutory limits of supply. The majority of these are rural parishes, but the authorities of 51 urban districts have 165 other urban districts either wholly or partly within their limits, including the town councils of Bradford with 18, Huddersfield 16, Manchester 10, Barnsley 9, Halifax, Liverpool, and Wolverhampton 8, Stockport 7, Bolton 6, and Nottingham and Rochdale 5.

Limits of Joint Authorities.—All the joint authorities with statutory powers are authorised to furnish supplies in urban areas, and the limits of 20 joint authorities comprise either the whole or parts of 128 urban districts. In addition, the limits of the Abertillery and District Water Board, when its works are completed, will include four urban districts at present within the areas of other undertakings. No definite limits are prescribed for the Derwent Valley Water Board, which is empowered to furnish water in bulk to the town councils of Derby, Leicester, Nottingham, and Sheffield, and to various authorities in the counties of Derby and Nottingham. The limits of the Metropolitan Water Board include 55 urban districts, of the Bury and District and the Fylde Boards 9, of the Ashton-under-Lyne, &c., Board 8, of the Heywood and Middleton Board 7, and of the Accrington and District and the Tees Valley Water Boards 6.

Limits of Companies, &c.—Of the 200 companies with statutory powers, 148 are empowered to supply within urban districts, and there are 292 urban districts wholly or partly within their limits. The limits of the South Staffordshire Company include 19 urban districts, Weardale and Consett Company 16, Newcastle and Gateshead Company 12, Colne Valley Company 8, Barnet, South Essex, and Sunderland and South Shields Companies 6, North Cheshire, Rhymney and Aber Valleys, Rickmansworth and Uxbridge Valley, Staffordshire Potteries, and West Cheshire Companies 5.

The limits of 6 of the 11 private proprietors with statutory powers each include an urban district.

Local Acts of Rural District Councils.—Five rural district councils with special Acts already mentioned are not empowered thereby to supply water outside their own districts. The limits specified in these Acts refer only to the works authorised therein, and do not take away the councils' powers under the Public Health Act to supply other parts of their districts.

Overlapping Limits.—In some cases two undertakers have concurrent powers of supply in the same parish or district. It appears from the return that 37 boroughs and urban districts and 72 parishes in 41 rural districts are situated wholly or partly within the limits of more than one undertaking. In these cases the limits actually overlap, in others the parish or district is divided between the undertakings. The former are cases in which the limits were fixed by an early Act. It is not now the practice of Parliament to authorise the inclusion of areas within the limits of more than one undertaking.

Places within Limits and Places Actually Supplied.—The following table shows the number of districts and parishes within the statutory limits of the various classes of undertakers, and the number of them actually supplied with water:—

Undertakers.	Number of districts and parishes within statutory limits.			
	Total.		Actually supplied.	
	Boroughs and urban districts.	Parishes in rural districts.	Boroughs and urban districts.	Parishes in rural districts.
Local authorities ...	904	876	392	534
Joint authorities ...	128	272	122	188
Companies ...	697	1,824	293	1,213
Private proprietors	6	18	5	16
Total	815	2,990	812	1,951

In the table 49 boroughs and urban districts and 106 parishes have been counted twice, and one urban district and two parishes three times, being partly or wholly within the limits of more than one undertaker.

In the case of urban districts there are only 33 within statutory limits which are not supplied by the undertaking in whose limits they are placed, and this is to some extent accounted for by the fact that 50 urban districts are within the limits of more than one undertaking. In the case of rural parishes, however, there are no less than 1,039 parishes not supplied by the undertakers within whose limits they have been placed by statute, and in only 108 of these cases can it be assumed that they obtain a piped supply in virtue of their being also within the limits of another undertaking. Thirty per cent therefore of the rural parishes which have been included within the statutory limits of water undertakings remain unsupplied, and when it is considered that by the mere fact of their being placed within those limits the local authority has lost its right to supply them under the Public Health Acts, provided the undertakers are able and willing to furnish a supply on the terms referred to above, it becomes apparent that the interests of a parish may be seriously prejudiced by being included within the statutory limits of a water undertaking.

The Local Government Board have been accustomed to report to Parliament on Bills for Local Acts proposing to include new areas within water limits, urging the committee which is to consider the Bill to satisfy themselves that there is a reasonable likelihood of the company or local authority, as the case may be, being able to provide a sufficiency of wholesome water for the supply of the places proposed to be taken into the limits, and that there is a *bonâ-fide* intention to supply them. As a result, the limits proposed in local Bills have in a number of cases been curtailed. Nevertheless, cases have occurred in which a parish within the statutory limits of an undertaking which is willing to supply it only on exorbitant terms is badly in need of water, and could obtain it readily and cheaply from a separate scheme of the local authority, or from some other undertaking, and the undertaking with the monopoly will not give up its right to supply.

In the case of a Bill promoted by the West Gloucestershire Water Company in 1914 the Local Government Board in reporting to Parliament on the Bill drew attention to the failure of the company to provide a supply in certain parishes in a rural district which had been added to the company's limits of supply by a local Act of 1899, and suggested that, if the cost of supplying the parishes with water from the company's works was such that the income to be derived from the supply, at the rates authorised by the Acts of the company, was insufficient to give a reasonable return on the expenditure, the committee should consider whether the proper course would not be to exclude the parishes from the company's limits, and thus to enable the local authority to provide a supply under the provisions of the Public Health Act, 1875. The committee, after hearing evidence, took the course suggested by the board.

Undertakers supplying Water outside their Statutory Limits.—Special Acts sometimes contain clauses requiring undertakers to furnish supplies outside their limits by way of compensation, and authorising them to supply water in bulk to neighbouring authorities. The number of undertakers with special powers that

supply water outside their statutory limits is shown in the following table:—

—	Undertakers with special powers.	Undertakers supplying outside their statutory limits.	
		Directly to consumers.	In bulk to local authorities.
Local authorities ..	229	65	60
Joint authorities .	29	6	7
Companies	200	48	8
Private proprietors ...	11	—	—
Total	470	119	75

Twenty-two local authorities, two joint authorities, and two companies have been counted twice in the table, as they supply both directly and in bulk.

Local Authorities Supplying Water to the Authorities of other Districts under the Public Health Act, 1875.—Sec. 61 of the Public Health Act, 1875, enables a local authority to furnish supplies of water outside its district with the sanction of the Local Government Board. The board have given such a sanction to 106 authorities, and the return shows that 102 are furnishing supplies outside their districts.

Places Supplied by Joint Committees.—Of the 12 joint committees constituted under the Public Health Act, 1875, or the Local Government Act, 1894, one supplies the borough of Tamworth and another the urban district of Highbridge. Parts of Ludgvan and Westbury urban districts are also thus supplied, and one committee supplies water in bulk to three urban district councils. The majority of the supplies, however, are furnished in rural districts, supplies being afforded in 49 parishes.

Places Supplied by Private Companies and Private Proprietors.—In addition to those places which obtain water under statutory authority, a number of districts and parishes are supplied by companies and private proprietors without any powers. Of the 84 private companies one supplies a small part of the city of Bath (the greater part being supplied by the town council), 3 supply parts of the boroughs of Berwick-upon-Tweed, Colne, and Glossop, 17 furnish supplies in 15 urban districts, but of these only the 3 small urban districts of Dolgelly, Hetton and Watchet are wholly supplied.

The majority of private proprietors supply solely in rural districts. Of the total of 1,055, 17 furnish supplies in boroughs and 110 in urban districts, but in most cases to a very small number of houses only.

(To be concluded.)

CORRESPONDENCE.

Εις ἀνηρ ὸν πάνθ' ὁρᾶ

(One man does not see everything.)

—Euripides.

ROADS AND HEALTH.

To the Editor of The Surveyor.

Sir,—Some time ago I saw in a report in your journal the statement that since certain roads had been waterproofed the local death-rate had gone down.

In my opinion this is a very important point, and I should be glad to know if any of your readers are aware of any other instances where waterproofing the roads has been followed by a reduction in the death-rate. Yours, &c.,

Salus Populi.

August 14, 1915.

Practice and Precept.—On the receipt of a Government circular urging local authorities to practise economy, the Basford, Notts, Rural District Council ordered a reply to be sent advising the Government to set an example. The clerk said that had a practical suggestion, forwarded by a Nottingham representative meeting to the Registrar-General, been accepted, it would have saved 23,000,000 envelopes in connection with the National Registration certificates. Mr. B. Smith, one of the members, complained of the number of unnecessary publications wastefully issued by the Local Government Board and Board of Education, and declared that on recent visits to those departments in London he was surprised to see the number of young men of military age running about.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not rather interesting to note that motors are playing such an important part in the present war, and that roads are even more necessary for transport purposes than in times of peace? Apropos of this, was it not a somewhat novel idea of some socialists in Germany who thought they might help to bring the war to an end by surreptitiously spreading broken glass and nails on the surface of the roads in Germany and Belgium frequented by military motor vehicles, the idea, of course, being to cause punctures in tyres, and thus delay the transport of munitions?

* * * *

While the Government of our country is preaching economy in all directions, is it not rather a scandal that large sums of money are being spent in our public parks and pleasure grounds in laying out elaborate and costly beds of perishable flowering plants? Would not most of our parks and pleasure grounds be really more enjoyable if left as pleasure grounds, where people might roam at will, and where the cost of upkeep would be but trifling? In connection with this also, does it not seem strange to see so many able-bodied young men working as gardeners in these parks, when they should be serving their country in more manly and useful pursuits? When will this country wake up to the fact that unless we bestir ourselves disaster will overtake us?

* * * *

Is not the sad case of Mrs. Bradshaw, to which The Surveyor has drawn attention, an object-lesson to all surveyors to support the Orphan Fund of the Institution of Municipal and County Engineers? What is the real reason that this fund receives so little support from the men who are most likely to benefit from it? Is it apathy, poverty, carelessness, suspicion, selfishness, or what is it that makes them hang back? Why is it that the municipal surveyors, as a body, do not appear to have that cohesion which is marked in other professions?

* * * *

Would not an exhibition of the various forms of impromptu sanitary appliances now used at the Front be of special interest at the present time to all sanitarians? Is it not evidence of considerable ingenuity that such articles as meat safes, water strainers, grease traps, baths, urinals, fly traps, vermin treatment boxes, and so forth should be made out of old biscuit and meat tins, old boxes, sacking, wire netting, and any old waste materials? Is it not surprising that human ingenuity properly applied can make use of our waste products? Is there not still an enormous field open in the direction of the use of our now often wasted materials?

* * * *

Is it not due to the brains and work of the sanitary section of the Territorial Royal Army Medical Corps now attached to the British Expeditionary Force that so much useful work in the above direction has been carried out? And should not able-bodied men who may now be less usefully employed in work that could be performed by older men, seek to join this admirable branch of our Services?

Preliminary Studies in Bridge Design.—This little book,* a reprint of articles which appeared in The Surveyor and Municipal and County Engineer, is intended as the first of a series of similar volumes which, taken together, will form a treatise on the design of ordinary highway bridges of moderate spans. This first volume goes further back in the evolution of the bridge than do most treatises, and considers the bridge in its essential elements, that is as the means of providing a crossing for man and beast across a watercourse. The bridge engineer is apt to forget this primary purpose and to consider his bridge merely as a framework or a carrier of stresses. Mr. Ryves, in a refreshingly original manner, has emphasised the necessity for studying natural and economic predispositions, one might say, of the bridge site, with a view toward producing, not the best type of bridge, but the best method of getting the river and the traffic across one another. . . . —*Engineering News*, New York.

* By Reginald Ryves, Assoc.M.Inst.C.E. London: St. Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s. nett.

ACTIVATED SLUDGE EXPERIMENTS IN CANADA.*

By R. O. Wynne-Roberts, M.Inst.C.E.

The City Commissioner of Regina, Canada, on the advice of Mr. Harrison, the author of experiments to be made on the treatment of sewage on the latest and very promising method. There are two advantages from tanks with glass windows. Each tank is 4 ft. 7½ in. in diameter and 24 ft. deep, and has a 2-in. cattle pipe secured to the centre of the floor. The capacity of each tank is 105 gallons per vertical foot, and about 2,400 gallons of sewage was treated, using nearly 377 gallons in each tank.

No. 1 tank was treated by straight air blowing. An old Ford automobile engine was converted into an air compressor, and an old steel gasoline barrel was used as an air receiver. The air supply pipe is slightly enlarged near the top to allow an orifice plate with 2-in. diameter opening to be inserted for the purpose of measuring the air. The air pipes are connected across the top and bottom of the tank so as to equalise the pressure. The distributing pipes at the bottom of the tank are perforated at 6-in. centres and a canvas sleeve inserted over each to diffuse the air. This answered fairly well in the experimental stage of the tests, but something more durable will be required for permanent work. The air receiver smooths out the oscillations due to the compressor, and makes it possible to maintain almost uniform air pressure. As already stated, the air was measured by means of a 2-in. orifice plate, and a water-gauge showed the difference in the pressure on the inlet and outlet sides of the orifice plate, and computations were made according to recognised formulæ.

No. 2 tank was treated by agitating the sewage. A centrifugal pump was connected to the central outlet and delivered the sewage back again by a vertical pipe which has a Venturi throat cast inside, and the sewage has consequently to pass through the constricted throat at a much higher velocity than in the plain pipe. In doing so it draws in air near the elbow, and the mixture of sewage and air is driven nearly to the bottom of the tank, where it strikes a cone, which causes the sewage and air to spread out to the perimeter. The air in this case is measured by a brass plate fixed on the air inlet, and having a ¾-in. orifice. As the air is drawn in, or is under slight vacuum, the negative pressure is measured by means of a glass tube inserted in a glass vessel by noting the height to which water is raised by suction, or, more correctly, noting the atmospheric pressure and the pressure in the air intake.

The pump was difficult to control under the conditions of the experiment, as too great a delivery of sewage would cause a greater quantity of air to be injected than was required, while if the valves were checked they were liable to be choked by the sludge. Consequently some energy was lost and was converted into heat in the sewage, with the result that the temperature of No. 2 tank rose from 58 deg. Fahr. to 87 deg. Fahr. The temperature in No. 1 tank rose to 68 deg. Fahr., but this was due to the rise of the atmospheric temperature.

The air compressor and centrifugal pump were driven by an old electric motor; no record was kept of the power consumed, inasmuch as the pump was not performing its duty and some of the air was allowed to waste.

This experimental plant is located in a spare part of the boiler-room of the power-house.

The experiments were started on May 18, 1915. When No. 1 tank was charged with raw sewage from the disposal works. No. 2 was started on May 20th. Air was blown in one and injected into the other for two days, when a pailful of concentrated sewage from houses which are not yet connected to the sewers was poured into No. 2 tank. Three days later another pailful was poured into each tank, and this was repeated about seven times.

No. 2 tank, being warmer, was evidently more active than No. 1, for a copious quantity of froth was generated. In both cases the sludge and liquid changed from dull slate-black colour to brown.

The quantity of air intended to be supplied was at the rate of 15 cub. ft. per square foot of tank area per hour; this was fairly well maintained in No. 1 tank, but not so well in No. 2 tank, owing to the valves or pump being choked with sludge.

Samples of the tank mixture were taken daily and allowed to stand on a shelf in the boiler-room, but no odour was emitted other than that of earth. The sludge subsided quickly, leaving a yellowish supernatant liquor.

While the pails of concentrated sewage were being dumped into the tanks the odour was pronounced, but in less than five minutes no smell was noticed. When it was proposed to locate the tanks in a part of the boiler-room the men made objections, but the experiments have been conducted since May 18th, and no complaint whatever has been made regarding the operations. The absence of smell was an agreeable surprise to the men engaged in the power-house.

The writer's connection with the experiment ceased on May 31st, since when the city engineer, Mr. F. A. M. Arthur, has had charge.

* Reproduced from the *Canadian Engineer*.

"STEAM-WATER" SYSTEM OF HEATING.

Readers of The Surveyor will be interested in a new system of heating which the firm of Revy, Phillips & Co., Limited, 181 Queen Victoria-street, E.C., have introduced, and of which several installations have, we are informed, been running for some time most satisfactorily.

The "Steam-water" non-pressure unit system of central heating, as it is styled, is described by the company as a system of central heating by means of radiators, low-pressure steam being the primary and water the secondary heating mediums. The principle of the system is that steam, at preferably low pressure, is conveyed through small-bore pipes to radiators, which are automatically charged with water, the steam heating the water and simultaneously condensing and passing back by gravity to the boiler. There is no pressure on the radiators, as the condense drainage is free.

The method of operation is as follows: A low-pressure steam pipe is taken from the boiler with branches to each radiator, the inlets being fitted with a special control and silent steam heater. The steam, in passing through this fitting, causes a vacuum to be set up, assisting the flow of steam into the radiators, and as soon as the water contained therein reaches the prearranged temperature of, say, 180 deg. Fahr. or 190 deg. Fahr., &c., the thermostatic valve automatically closes down until such time as the temperature falls again. The condensation that is set up passes away through the overflow either through a return bucket to the boiler or to the sump.

As soon as the steam valve on boiler is opened the whole installation immediately responds, since there is no circulation movement to contend with. The body of water to be heated up in this system is reduced 20 per cent to 30 per cent, and therefore requires less fuel to be burnt to obtain the temperature.

As will be readily appreciated, the "Steam-water" non-pressure unit heating system has all the advantages of both the steam and hot-water systems; it has the low-temperature radiators of the hot-water and the small-bore piping of the steam, while it does not require any mechanical acceleration. It has the distinct advantage that, owing to the automatic thermostatic control, steam—*i.e.*, fuel—is only used in direct proportion to the heat units required for heating the radiators, which means considerable economy in working.

There is no danger from unskilful or careless operation of the radiator valve as might cause accumulation of condensation. The inlet valve may be fully or entirely shut off, or adjusted to admit any desired volume of steam to the radiator, without causing any trouble, since the drainage of condensation is free.

As pressure and temperature are, in the case of steam, inter-dependent, every increment of pressure shows a corresponding increment of temperature, and it becomes clear that the important and valuable feature of the "Steam-water" system is that, no matter at what temperature the steam is supplied to the radiators, they cannot in any event exceed 212 deg. Fahr., and may be set and controlled at any less temperature—say 160 deg. Fahr., &c.—making this system, it is claimed, a perfect one for all general purposes.

Sewer Explosions at Aldershot.—An explosion occurred at Aldershot on Wednesday, when, presumably as a result of gases accumulating in the town sewers, a number of manholes were blown into the air with loud reports. Fortunately no one was injured by the explosions, which were spread over an area of over a mile.

Kingston-upon-Thames Sewage Disposal Works.

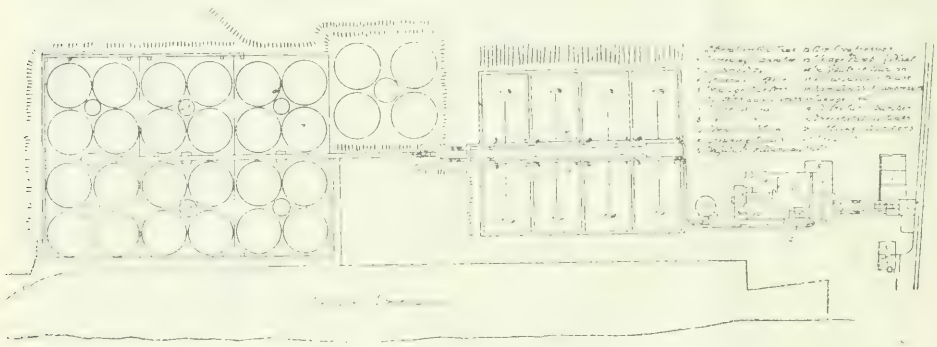
By R. HAMPTON CLUCAS, Borough Surveyor, Kingston-upon-Thames.

[Members of the Institution of Municipal and County Engineers, it will be recollected, made an inspection of these works on the occasion of the recent annual meeting of that body, and the subjoined paper was prepared by Mr. Clucas for the information of the visitors.]

The Kingston sewage works are interesting inasmuch as they do not comply with the Local Government Board regulations. The effluent comes within the purification standard required by the Thames Conservancy, and the Royal Commission have taken a special interest in this process owing to the percentage reduction of suspended matter in the crude sewage.

These works were built by the Kingston Corporation, and opened in 1888, in order to carry out the A.B.C. system of sewage purification operated by the Native Guano Company. They were designed by the author's predecessor, Major Macaulay, and have now been working twenty-seven years. The scheme was designed without filters, and was continuously carried on by the Native Guano Company for many years by tank precipitation only, and for some time by single contact filtration. The original cost of the works was £23,000, and they were designed for a population of 35,000, and until 1913 had to be used for a population made up as follows—viz.: Kingston, 38,440; Surbiton, 18,000; Hampton Wick, 2,560; total, 59,000.

The agreement with the Native Guano Company terminated in 1908, and since then the corporation have carried out the system of purification. In 1913 Surbiton agreement expired.



Kingston Sewage Works.

The works at present deal with a population made up as follows—viz.: Kingston, 38,440; Hampton Wick, 2,560; total, 41,000. Surface water is partly excluded from the sewers. The average daily dry-weather flow of sewage is about 1,759,743 gallons, which amounts to an average of 42·9 gallons per head.

The sewage, on reaching the works, passes into the screening chamber and through gratings, ¾-in. mesh, which intercepts coarse matter likely to choke or injure the pumps, and thence through a culvert to a pump well under the main building, where it receives the purifying mixture. The size of the pump well is 25 ft. deep and 14 ft. in diameter, the bottom being 4 ft. below the invert of the 4 ft. 6 in. by 3 ft. main sewer.

Two storm overflow weirs are provided in the screening chamber, one 17·50 above ordnance datum, discharging into a storm-water tank, 60 ft. by 30 ft., and one storm overflow 18·00 above ordnance datum discharging into the Thames; the latter comes into operation when the volume exceeds four times the dry-weather flow. A third storm overflow in screening chamber is provided, and controlled by a penstock.

Steam plant for pumping was discontinued after the corporation took over the works from the company and electric power substituted. The charge for power is ⅜d. per unit.

The sewage partially treated is raised about 12 ft. by two motor electrically direct-driven pumps, 10-in. Gwynnes, each with a capacity of 2,000 gallons of sewage per minute, with a current consumption of 16 units per hour. A third 10-in. pump, Rees-Roturbo, is being installed. Each pump is provided with hand holes and inspection doors. The pumps are direct-coupled to a 20-b.h.p. alternating current Fuller motor. The pumps discharge into a meter chamber, where the sewage is measured by the quantity registered. On leaving the meters the sewage flows along an open channel to the settling tanks, receiving on its way the precipitating agents.

One 50-h.p. and one 55-h.p. motors, 880 r.p.m., are installed for driving the main shafting and countershafting. The following machinery is driven from the main shafting—viz.: Mortar mills and mixer, three air pumps, sludge pumps, water pumps, lathe, compressors, and bauxite grinders. The electric plant was installed under the borough electrical engineer's supervision. The mortar mills are used for grinding the chemicals, which are then mixed in two vats and discharged into the pump well. The other vats are used for dissolving the precipitating agents.

HAMPTON WICK SEWAGE.

The author was requested to prepare a scheme to supply Hampton Wick, situated on the Middlesex side of the river Thames, with compressed air, so as to be able to convey the sewage from Hampton Wick to the Kingston works for treatment. The following plant was laid down: Two belt-driven air compressors, each with a maximum capacity of 240 cub. ft. of free air per minute compressed to 15 lb. pressure. The machines are horizontal, 15 in. diameter, and twelve strokes each, having two pairs of fast and loose pulleys so as to enable the machines to run either of two speeds, and each with one automatic air-retaining device. Admission and delivery of the air from the cylinders is regulated by a 5-in. diameter piston valve. The air pipe from the Kingston works is carried over the railway bridge spanning the river Thames to the ejector station at Hampton Wick, and a return sewer pipe along the bridge back to Kingston. All the work outside the Kingston works was carried out by Mr. Taylor, surveyor to the Hampton Wick Council. Messrs. Geo. Scott, of London, supplied the air compressors.

TANKS.

There are eight tanks, each 85 ft. long by 50 ft. broad, and 6 ft. average working depth, holding 150,000 gallons or 1,200,000 gallons in the aggregate, which gives a capacity of 29·26 gallons per head for the present population of 41,000.

The tanks are partially divided in the middle longitudinally by a wall, about three-quarters the distance of the entire length. The tanks are deeper at the near ends and shallower at the rears, so that the tendency of the sludge deposited is to gravitate towards the front wall, while the dividing wall tends to cause the fluid portion to circulate round into the second half of the tank, giving more time to

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settle before the surplus water runs off by openings controlled by sluice gates. Attached also to the same front wall of each tank is a draw-off arm to decant the supernatant water. The water so decanted off is conveyed by an iron pipe to the same place of discharge as the effluent. Another jointed pipe in the same wall is let down into the sump hole, and the sludge drawn off by a Tangye-Holman double-action pump at the rate of 500 gallons per minute and ejected into a circular sludge tank, whence it is drawn off as required and conveyed by an iron pipe to six iron vertical accumulators by creation of vacuum, and is then forced by air pressure at 100 lb. per square inch into twenty-one filter presses on the first floor of the building.

The pressed cake is sold to the Native Guano Company, the company paying 1s. per ton, the corporation delivering into barge alongside the works. The company dry the cake, which is sold under the name of "Native Guano."

FILTERS.

From the precipitation tanks the effluent passes onwards through a small settling chamber into a main open carrier to the filter beds. The whole of the single-contact beds, six in number, have been converted into percolating filters fitted with sprinklers supplied by the Patent Automatic Sewage Distributors. Each bed is provided with four 50 ft. in diameter sprinklers and one 20 ft. in diameter, making a total of twenty-four 50-ft. sprinklers and ten 20-ft. sprinklers. The depth of the beds vary from 3 ft. to 3 ft. 9 in. Five additional filters have been constructed, using burrs instead of walls, four 50 ft. in diameter and one 20 ft. in diameter and 5 ft. deep. The total filtering capacity of the above filters is 7,566 cub. yds., the maximum rate of filtration being 300 gallons per cubic yard of material. The filtering material of No. 4 filter is broken coke, and graded as follows—viz.: Large coke, 18 in. in depth at the bottom; remainder, 1-in. to ½-in. graded coke. The material used in connection with the other filters is as follows—viz.: 4-in. gauge clinker, 12 in. in depth at the bottom; remainder, 2-in. to ½-in. pan breeze.

RESULTS OF THE PROCESS EMPLOYED.

The substances employed are sulphate of alumina, clay and carbon. From various analyses both of the albuminoid ammonia and oxygen absorption of the tank effluent, the purification effected in the tanks is found to vary from 75 to 80 per cent upon a crude sewage of normal strength, which contains considerable quantities of gas and brewery refuse. The actual chemical condition of the tank effluent and the filtrate may be gathered from the results of many years' continuous working.

Recent Analyses Giving the Following Results.

Parts per 100,000.

	Chlorine.	Free NH_3.	Albd. NH_3.
Sewage	9·0	5·5	1·37
Tank effluent	8·6	4·0	·35
Filtrate	8·3	1·5	·08

The purification being—Tank treatment, 74·54 per cent.; filtration of tank effluent, 77·10 per cent.; total, 94·18 per cent.

MANUFACTURE OF ALUMINA.

The author and manager inspected the plant laid down by the borough surveyor of Chorley for the manufacture of alumina, and the author reported to the Drainage Committee the desirability of adopting a plant following the lines of Chorley with improvements. The work was sanctioned and erected in 1910. Prior to the Kingston Corporation manufacturing alumina the corporation purchased 800 tons per annum of aluminoferric at 49s. 6d. per ton; the cost to manufacture alumina is 30s. per ton, which shows a balance in favour of the corporation of £780 per annum.

ALUMINA PLANT.

From the river Thames wharf a 2-in. lead pipe, 28 lb. per yard, is laid 107 yds. and connected to a store tank having a storage capacity equal to 50 tons. The sulphuric acid is delivered in tank barges containing 50 tons alongside the wharf, and then forced by compressed air into the storage tank.

Two vats, each 5 ft. by 5 ft. by 4 ft. of 1½-in. deal, lined with 15 lb. lead, bottom and sides 1 ft. high, remaining 3 ft. with 8 lb. lead, and having coils of 1½-in. diameter, 24 lb. lead, 42 ft. long, are provided for boiling the acid, bauxite and water. Steam is supplied from a boiler in the basement, and connected to the tanks for boiling purposes. Compressed air is used for agitation and for delivery of acid from the store to the vats.

A Sturtevant "open top" rotary crusher is provided for the preliminary crushing of bauxite and for feeding the 24-in. Sturtevant vertical emery mill which is used for the fine grinding, say 80 to 100 mesh. The total cost of the plant was under £400.

PROCESS OF MANUFACTURE OF ONE TON OF ALUMINA.

Dry bauxite, 6 cwt.; sulphuric acid, 9 cwt.; water, 6 cwt.; boil in one of the vats to 220 deg. Fahr. for about seven hours, run same into moulds provided on floor below, and allow same to remain until set. The cost per ton is as follows—viz.:—

	£	s.	d.
6 cwt. bauxite at 1s. 1d. ...	0	6	6
9 cwt. sulphuric acid at 1s. 10d. ...	0	16	6
6 cwt. water		—	
Labour	0	3	0
Power 3 hours' grinding	0	2	0
Compressed air for agitation steam for boiling	0	2	0
	£1	10	0

Bauxite is purchased at 40 per cent alumina on samples dried at 212 deg. Fahr., at £1 per ton delivered alongside; sulphuric acid of 80 per cent at 36s. 6d. per ton, delivered into tank.

STATISTICS OF WORKING COST.

Average gallons per day, 1,759,743; average gallons per head, 42·9; population calculated, 41,000; cost per head per annum, 1s. 11·2d.; cost of chemicals per 1,000,000 gallons, £1 8s. 3·3d.; cost of pumping per 1,000,000 gallons, 10s. 11·5d.; chemicals used, grains per gallon (about), 25; tons of pressed cake per 1,000,000 gallons, 6·46; total cost per 1,000,000 gallons, £6 3s. 6d.

The author would like to acknowledge many valuable improvements and suggestions made by Mr. Lloyd, manager of the sewage disposal works.

Sunday Road Sweeping. It was urged at a recent meeting of Newton Abbot Urban District Council that it was unnecessary for the council's employees to be sweeping the streets on Sunday mornings. The surveyor, Mr. C. D. White, said the men formerly did the sweeping on Saturday nights, and they themselves asked that they could do the work on Sunday mornings. One of their reasons was that they liked to get Saturday afternoon off and did not want to come back in the evening to work. All the work was finished before 8 o'clock on the Sunday morning.

Law Notes.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Editor," at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter X, combinations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.*

PRIVATE STREET WORKS APPORTIONMENT. "Apportionment" writes: The accompanying plan shows a street which it is proposed to make up under the provisions of the Private Street Works Act, 1892. A resolution has been passed by the council instructing the surveyor to prepare plans, specification, estimate, provisional apportionment, &c., the cost to be apportioned on the premises fronting, adjoining or abutting on such street. The surveyor, in preparing his apportionment included a measurement of 36 ft. for the land abutting on the northern end of the street and numbered 13 on the plan. This land has an area of probably 2 acres, but, owing to the unsatisfactory levels for drainage purposes, it will probably never be developed for cottage property building; but as it adjoins the canal it is an eligible site for a factory or works. At present the land is used as allotment gardens, and the owner receives the rents. The agents for this land happen to be the clerks and solicitors to the council, and rather contend that it is not right and equitable for the surveyor to include their 36 ft. of abutting land in the frontage measurements. The surveyor, in his provisional apportionment, has added together the frontages on the east and west sides of the street, plus 36 ft. for the land marked 13 at the northern end of the street, and divided the estimated cost by the total frontage. The price per lineal yard of frontage is the same for all owners, including the owner of the land referred to. The surveyor contends that this method is correct, and would be upheld if an objection was taken before the magistrates. No resolution has been adopted by the council instructing the surveyor to take into account the degree of benefit to be derived by any properties, as may be done under sec. 10 of the Private Street Works Act, 1892. There is a permanent gateway built into the brick wall at the northern end of the street, giving access to the land from Hollowgate-avenue, and this is the only road used by the tenants of the allotments when proceeding to their gardens. The estimated cost of the proposed street works, including complete surface-water drainage system, excavation, kerbing, channelling, tarmacadam footpaths, 8-in. ballasting, and 3-in. slag-macadam carriageway, contingencies, 5 per cent supervision, &c., is £450 5s. 9d. for a frontage of 305·52 lin. yds., or, say, nearly 29s. 6d. per lineal yard of frontage. The street is 440 ft. long by 36 ft. wide. (*a*) Do you consider the surveyor has adopted a proper and legal method of apportionment and one which would be upheld by the magistrates? (*b*) Do you consider the estimated cost a reasonable or excessive one?

(*a*) Yes. We think the method adopted is correct, and was the only legal method open to him. By sec. 10 of the Act he is *bound* to make the provisional apportionment according to the frontage of the respective premises unless the urban authority resolve otherwise as provided by the section. Moreover, on an objection against a provisional apportionment, the justices have no jurisdiction to consider "degree of benefit" in the absence of such a resolution. (*b*) This is a pure question of fact upon which we cannot advise, save to point out that in considering whether proposed works are reasonable regard must be had to the existing state of things in the street (*Corporation of Sheffield* v. *Jackson*, 64 L.J.M.C., 44).

CROSSINGS OVER FOOTWAYS. "Crossings" writes: I shall be glad to have your opinion with regard to the responsibility for pipes in channels and private crossings, as outlined in the queries set out below. In the case of pipes laid in the road channel against the kerb to facilitate access to private premises—(1) Who is responsible for maintaining such pipes in safe condition? (2) Who is responsible for keeping the pipes clear, the road authority or the persons benefited? (3) I take it the sanction of the road authority to the placing of existing pipes must be assumed, as no objection appears to have been made, but in the case of fresh applications, can conditions be imposed at the time of granting permission covering the question of maintenance? (4) In the case of private crossings over public roadways, the law appears indefinite; the rule here is to apportion the cost between the persons benefited and the road authority, and as the work is done by, and to the satisfaction of, the road authority, the latter maintains the work as part of the pathway. Where the crossing is safe and satisfactory for pedestrians, but has worn slippery, can the council be required to roughen the setts forming the crossing, when the only persons benefited will be clients of the occupier of the premises?

(1) Assuming that the question relates to streets that are highways repairable by the inhabitants at large, the council are liable for the maintenance of these pipes under sec. 149 of the Public Health Act, 1875. (2) This work, in our opinion, is part of the cleansing of the street, for which the council are responsible under sec. 42 of the Public Health Act, 1875. (3) We think yes, under the general power given by sec. 173 of the Public Health Act, 1875, to enter into contracts. (4) Yes, assuming there is no agreement to the contrary. The liability for the repair of streets is by sec. 149 imposed upon the council.

ERECTION OF NEW BUILDING. DEPOSIT OF PLANS. "Bon-Acord" writes: I shall be very glad to have your opinion upon the following point: A large structure in this district is constructed of brick and timber (external walls). The gable end, for a length of about 5 ft., has been pulled down for road-widening purposes by a county council, and a new end has been constructed entirely of timber framing covered with weather boarding. The new end is close up to the footpath, and less than 40 ft. from the opposite side of the street, as required for exemption under By-law 5 v. One side of the structure is also built up to property of the owner adjoining, and is thus less than 20 ft. therefrom, as required for exemption under the same by-law. (1) Is the construction of the new end the "erection of a new building" within the meaning of sec. 23 (*a*) of the Public Health Acts Amendment Act, 1907? (2) Ought plans to have been deposited for this work under By-law 88?

(1) The answer to this depends upon whether or no the work described is a "partial re-erection" of the building within the meaning of sec. 23. We are not aware of any decision involving the interpretation of these words, but the question appears to be one of degree, which must be decided with reference to the facts of each particular case (*cf. James* v. *Wyrill*, 1884, 48 J.P., 725), and so is not really a question of law at all. (2) By-law 88 requires that "every person who shall intend to erect a *building*" shall deposit plans, &c., but inasmuch as by-laws as to structure can only be made *qua* "*new buildings*," it may be assumed that for the purposes of this query the word "building" in by-law 88 is equivalent to "new building." If, in fact, the work done is sufficient to satisfy justices that there has been a "partial re-erection," plans ought to have been deposited. The plans should be of the whole building, and not only the new portion (*Leonard* v. *Hoare & Co.*, 1914, 12 L.G.R., 844).

NEW BUILDING.—"Setback" writes: Public Health Act Amendment Act, 1907, Part II., Sec. 23.—Kindly say if, in your opinion, the taking out of the front wall of a building between the pavement and the first floor to insert a shop front can be deemed to be a new building.

We think not, although apart from the express provisions of sec. 159 of the Public Health Act, 1875, and sec. 23 of the Public Health Acts Amendment Act, 1907, it is a question of fact and not of law whether a building in any particular case is a "new building" (*James* v. *Wyrill*, 1884, 48 J.P., 725).

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 23 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

496. Stand for Procession.—A stand with seats is required, from which to view a procession, upon a site 40 ft. by 10 ft. The front is to be 4 ft. above pavement behind some iron railings. Give section and part plan to a ¼-in. scale.

497. Gauging Sewers.—Describe a suitable method for gauging the flow of sewers.

498. Buttress Design.—Thirty feet (30 ft.) above the ground a rectangular buttress bears a thrust of 5,000 lb. inclined at an angle of 45 deg. If the buttress is to be 3 ft. wide, and is built of masonry 140 lb. per cubic foot, find its thickness. Also find the height of a turret 3 ft. by 3ft. necessary for stability at the top joint if the coefficient of friction=0·60. (E. P. C., *Birmingham.*)

499. Geodesy.—Describe generally (without details) the astronomical observations needed to locate the starting-point of a survey in a new country. (E. P. C., *Birmingham.*)

500. Sewage Tank.—A sewer discharging into a sea outfall is connected to a storage tank l feet in length, b feet in breadth, and h feet in height. The tank discharges directly into the sea by means of an orifice a square foot in area, connected to low-water level by a short pipe of the same area, the top of the tank being at high-water level. Neglecting losses due to friction, and assuming that no sewage is admitted to the tank during the period of emptying, that the tide has a range of r feet, and that the tide curve is harmonic, find approximately the time taken to empty the tank. (Stud.Inst.C.E.)

501. Ventilation.—In designing a system of ventilation for a public hall, what are the relative advantages of a small number of large inlet shafts, compared with a large number of small shafts; and at what level should these inlets be placed? (N.Z.P. *Wellington.*)

REPLIES TO QUESTIONS.

495. Radius of Gyration.—Explain from first principles the precise meaning and significance of the term "radius of gyration" as used in the investigation of the theory of beams.

In order to understand the meaning of the term "radius of gyration," it is necessary to study the idea of the inertia of a body. The inertia of a body is the power of the body to resist external influences causing change of shape or of motion, and the measure of its power in respect to any fixed point or axis is known as the moment of inertia of the body about the given point or axis, and is denoted by I. The moment of inertia of a body about an axis is also called its second moment about such axis, the second moment being equivalent to the sum of the second moments of every element in the body about the axis. Now, if we imagine the whole mass or area of the body as concentrated at one, k distance from the axis as would cause the mass or area to offer an equal resistance to change of shape or of motion, we can find this distance for any particular case. This distance is the "radius of gyration" of the body about the given axis. It is thought by some that while the expression "radius of gyration" expresses well enough the idea above enumerated with regard to the kinetic energy of rotating bodies and similar problems, yet, applied to fixed objects, such as beams and columns, it is somewhat misleading. In order that this may be obviated, terms such as "radius of equivalence," &c., have been suggested, but have not yet come into general use. The radius of gyration of the cross-section of a beam, which is the quantity most often required in problems on the theory of beams, is obtained from the formula

$$\text{(radius gyration about given axis)}^2 = \frac{\text{(2nd moment of area about axis)}}{\text{area of cross-section}}$$

$$\therefore K^2 = \frac{I}{A}$$

Calculations in respect of beams are based on the theory that bending moment = moment of resistance $= f\frac{I}{y}$

From the first formula we see that $I = AK^2$, but the moment of inertia is most often calculated, and the second equation solved from that quantity. A clearer notion of the meaning of the term "radius

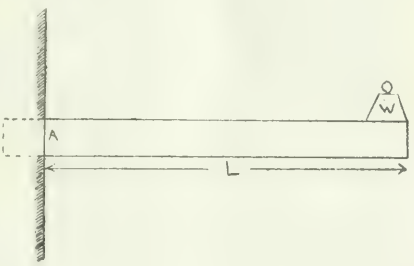

Fig. 1.

of gyration" may perhaps be obtained from a study of the proof of the formula: Bending moment = moment of resistance. In the case of a simple cantilever, length L, loaded at the free end with a concentrated load W, bending moment = WL. In

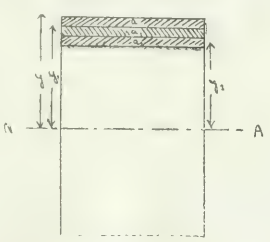

Fig. 2.

Fig. 2, let the areas of thin layers distant y, y_1, y_2, . . . from the neutral axis be a, a_1, a_2, . . . respectively, and let their intensities of stress be f, f_1, f_2, . . . respectively.

Taking moments about the pivot A, we have (see Fig. 1)—

$$WL = 2fay + 2f_1a_1y_1 + 2f_2a_2y_2 + \ldots$$

The beam theory proves that the stress in the fibres varies as the distance from the neutral axis—*i.e.*:

$$\frac{f}{f_1} = \frac{y}{y_1} \quad \therefore f_1 = \frac{fy_1}{y} \text{ and } f_2 = \frac{fy_2}{y}, \text{ \&c.}$$

Substituting for f, f_1, f_2, &c., we get

$$WL = 2fay + \frac{2fa_1y_1^2}{y} + \frac{2fa_2y_2^2}{y} + \ldots$$

$$= \frac{2f}{y}\left(ay^2 + a_1y_1^2 + a_2y_2^2 + \ldots\right)$$

The quantity in brackets is the moment of inertia of half the beam,

$$\therefore WL = \frac{2f}{y} \text{ (moment of inertia of half the beam)}$$

The two half sections are similar

$$\therefore WL = f\frac{I}{y}$$

If now we sum the symbols a, a_1, a_2, &c., in brackets, we get A, the area of the section; and

summing y, y_1, y_2, &c., we get the distance from the neutral axis at which the area of the beam must be concentrated in order to offer the same resistance to the bending moment—*i.e.*, the radius of gyration of the area. As we have the squares of y, y_1, y_2, &c., the summation of the quantity in brackets gives us $I = AK^2$; and this quantity, as shown above, forms the basis for calculating the power of resistance of a beam to external forces. (B. K., *Newport.*)

Let it be required to find the radius of gyration of a plane figure with respect to an axis in its plane. Suppose the lamina to be divided up into a very large number of small elements of area δA, and suppose the number of such elements be increased indefinitely; then the number of them becomes infinitely great, and the extent of each elementary area infinitely small. Now, the moment of inertia about a given axis in the plane of the figure of one of these elements is

$$\delta A \times y^2$$

where y is the distance of the area δA from the given axis, and the moment of inertia of the whole lamina about the same axis is the sum of such terms as the above—viz.:—

$$\Sigma\ \delta A\, y^2$$

The value of such summation is determined by the application of the integral calculus (*vide* The Surveyor, p. 358, March 5, 1915).

Let A be the area of the lamina and I its moment of inertia about the given axis; then, if K is the radius of gyration of the lamina about the axis we get

$$I = \Sigma\ \delta A\, y^2 = K^2 A$$

The above expression defines K; or we can write—

$$K = \sqrt{\frac{I}{A}}$$

We can explain the meaning of the term "radius of gyration" by stating that K is that distance of a point in the plane of the figure from the axis at which the whole area A may be concentrated without altering the value of the moment of inertia of the lamina.

Consider a beam under bending stresses.

Let M = resisting moment of the beam at a given section

F = stress at the extreme outer fibres of the section

I = moment of inertia of section of beam, about a horizontal axis through its centre of gravity

y = half the depth of beam

The well-known formula which applies when the elastic strains only are present is:—

$$\frac{M}{I} = \frac{F}{y}$$

$$M = \frac{FI}{y} = \frac{FAk^2}{y}$$

So that the resisting moment of a beam is proportional to the square of the radius of gyration. The section of an economical beam would therefore have a large value of the radius of gyration per unit area. Such a beam is the rolled-steel joist, and all other I-sections have this property.

The significance of K is directly seen if we examine Rankine's formulæ dealing with the determination of the safe load for columns or long struts which have a tendency to bend or deflect laterally under load. Rankine's formula is:—

$$p = \frac{P}{A} = \frac{F}{1 + a\frac{l^2}{k^2}}$$

where

p = safe load in tons per sq. in.

F = safe direct compressive for the material tons sq. in.

P = total safe load on column in tons (load axial)

A = area of section of column in sq. in.

l = length of column in inches

a = constant depending on the material

k = radius of gyration of cross section with respect to the selected axis in inches

The value of $\frac{l}{k}$ may be regarded as a measure of the slenderness of the column. (M. T. R., *Rhyl.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Bridlington T.C. (August 4th. Mr. H. Shelford Bidwell).—This was an adjourned inquiry into an application by the town council for sanction to appropriate a site adjoining the electricity works for the erection of a refuse destructor.—Mr. S. Dyer, formerly chairman of the borough Sanitary Committee, while admitting the necessity of having a destructor, maintained that the site chosen was too central, and must be a nuisance to the neighbourhood. He favoured a field immediately outside the town, which is about a mile distant from the proposed site, and which is also the property of the committee. He doubted the claim of the council that the financial gain would be considerable. Mr. J. S. Brodie, borough engineer of Blackpool, said they had one of the best destructors in the country, but no destructor had been built which was not a nuisance to some extent, and at Blackpool the council had had complaints even from its own council school 400 yds. away. The proper place for a refuse destructor was outside the town. He predicted that if a destructor was erected as proposed, one of the secondary schools in the district would be closed in a short time. Dr. J. Mitchell Wilson, East Riding medical officer, opposed, and said he would not recommend a parent to send a delicate child to a school so near to a destructor. The Rev. W. Slater, Baptist minister, believed the erection would do serious harm to the interests of the people in the vicinity, which was a summer letting district in July and August. Mr. John Bickersteth, county clerk and director of education, said if the county council had known the site was likely to be used for a destructor it would not have spent £20,000 on a secondary school in the district. The county council had secured enough land in the vicinity on which to erect a boarding-house, but if the destructor was erected he did not think the land would be used for such a purpose.

Huddersfield T.C. (August 18th. Mr. A. G. Drury).—£26,000 for the construction of new sewers in Fartown and Birkby.—It was stated that many houses in both districts were subject to floodings, owing to the inadequacy of the sewers. But for the war the application would have been made last year, and the town council could not see their way to defer it any longer.

APPLICATIONS FOR LOANS.

Llantarnam U.D.C.—£600 for works of sewerage.

Wilts C.C.—£1,000 for hospital extension.

LOANS SANCTIONED.

Barnsley T.C.—£15,220 for electricity plant.

Hythe T.C.—£668 for the construction of groynes.

Paignton U.D.C.—£2,787 for an isolation hospital.

Ruislip-Northwood U.D.C.—£360 for road improvement works.

FORTHCOMING INQUIRIES.

AUGUST.	£
24.—**Cockermouth.** For cemetery extension (Mr. F. H. Tulloch)	1,200
26.—**St. Helens.** For the purposes of the electricity undertaking (Mr. A. W. Brightmore)	15,000
27.—**Oadby.** For sewage works extension (Mr. A. W. Brightmore)	4,600

Metropolitan Asylums Board.—During the financial year which ended at Michaelmas, 1914, the nett expenditure of the board met out of the rates was £1,162,704, representing a rate of 6·20d. in the £, compared with an average of nearly 6d. for the preceding ten years. Since 1868, when the board contracted their first loan, over £5,600,000 has been borrowed for various purposes. The outstanding indebtedness was reduced during the year by £217,248, and at Michaelmas, 1914, stood at £1,887,035. The total nett reduction since 1906 has been £1,528,963, and in all £3,786,764—or 67 per cent—has been repaid. The outstanding debt is at the rate of 8s. 5d. per head of the population of London, compared with 15s. 7d. ten years ago, notwithstanding the large capital outlay in accommodation, which has been increased from 18,665 to 21,174 beds.

SOME RECENT PUBLICATIONS.*

Refuse Disposal. By Ernest R. Matthews, Assoc.M. Inst.C.E., Chadwick Professor of Municipal Engineering in the University of London. Price 6s. nett. London: Charles Griffin & Co., Limited.

The author of this volume is well known as a municipal engineer, and, as might be expected, the latest methods of disposal and the different destructor plants are discussed with impartiality. The chapters upon the collection of house refuse and insanitary methods of disposal are excellent, and it is satisfactory to note that the utilisation of house refuse by converting it into manure is fully dealt with in a separate chapter. After describing the various types of destructors, the author devotes considerable space to small destructors which are coming into use more and more for hospitals, domestic purposes and factories. Another valuable chapter is that dealing with utilisation of clinker, and the question of converting the power derived from the heat produced by the destructor is discussed in one of the earlier chapters.

Some time ago, in connection with National Health Week, a speaker at one of the meetings, in dealing with the danger of the dissemination of disease by dust, expressed the opinion that some day municipalities would collect all dust, both on the roads and in dwellings and factories, by a municipal vacuum plant. Although this has not yet come to pass, vacuum cleaning arranged for the collection of dust in buildings is already in practical use, and the chapter upon this subject in the present volume will serve a useful purpose in showing what can be done in this direction. Municipal engineers and those engaged in public health work will find the book both interesting and useful.

Railroad Field Manual for Civil Engineers. By W. G. Raymond. Price 12s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

The author of this field-book has ventured to base all his tables on a decimal division of the degree, instead of on the sexagesimal division hitherto adopted. There is much to be said for this as a practical step towards simplicity, and inasmuch as the necessary alterations in the instruments used can be made at a comparatively small cost, it is to be hoped that his boldness may be justified by success. At all events, no engineer need now refrain from using the decimal division on account of any difficulty in obtaining the necessary tables. For the rest, suffice it to say that the railway engineer will here find all the information he needs for his practical work in the field, arranged in a most convenient form.

Masonry. By M. A. Home. Price 6s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

This work, which comprises a complete, though concise, treatise on masonry construction, is divided into three parts, dealing respectively with materials, masonry and specifications. The object of the author is to describe modern methods and to illustrate modern tools and machinery, and in this he has well succeeded. The subject of reinforced concrete has been excluded in view of the numerous books which exist dealing with its various phases. Part I. deals with both natural building stones and artificial materials; while Part II. treats separately of stone masonry, brick and hollow tile masonry, and concrete masonry. The specifications in Part III. give the best modern methods of selecting materials and their use in structures. The whole work forms a complete treatise, clearly written, which will be appreciated by all interested in this important part of constructional work.

Valves and Valve Gears. Vol. I.: Steam Engines and Steam Turbines. By F. de R. Furman. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

This is the second edition of a work which has grown out of the author's lecture notes on the subject. Originally it referred chiefly to steam engines, and briefly to steam turbines. In the present edition the matter relating to present-day reciprocating steam engines has been considerably increased, the steam turbine has been treated much more completely, while the several types of the internal combustion engine are to be dealt with in a separate volume. The subject is treated from the standpoint of mechanism rather than from that of power, and the chief aim of the author has been to tell in particular, instead of in general, just how the engine or motor is regulated. The several types of prime mover valves are classified into seven fundamental forms, while the author has also made a grouping of six fundamental types of mechanism from which all practical valve-gear constructions may be formed. The work is clearly written, well arranged, and illustrated by a number of excellently drawn diagrams.

Pocket Notes and Remembrancer for Sanitary Inspectors. By J. T. Cowderoy. Price 2s. nett. London: The Sanitary Publishing Company.

The author of this very useful book writes with practical knowledge, being the chief inspector to the Kidderminster Corporation. As the title indicates, it is a note-book, and contains practical hints on every branch of the multifarious duties of the modern inspector. It is conveniently divided into sections, each of which deals with a separate topic, and a feature is the extracts from statutes which are strictly confined to those sections which directly affect the duties of inspectors. In our opinion Mr. Cowderoy has compiled a most useful pocket-book, which should be in the hands of every inspector.

Levelling and its General Application. By T. Holloway. Third edition by the Author and H. T. Tallack. Price 2s. 6d. nett. London: E. & F. N. Spon, Limited.

This is an elementary, though complete, text-book on the theory of levelling and its practical applications. Although intended primarily for students and the uninitiated, and so written throughout in simple language, the work contains much information that will be useful to the practitioner. The fact that two editions have been exhausted is sufficient testimony to the excellence of what we regard as a most useful text-book.

*Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

Wolverhampton Electricity Profits.—The Electricity Committee of the Wolverhampton Corporation report a gross profit on the electricity undertaking for the year ended last March of £28,631, and a nett profit of £7,111.

Carlisle Rural District Water Scheme.—The Local Government Board having declined to sanction a loan of £64,250 to the Carlisle Rural District Council for a water supply scheme, the council have appointed a sub-committee to approach the Carlisle Corporation to ascertain to what extent and upon what terms they were prepared to extend their supply into the rural district, and the lowest price at which they would sell water for the supply of those districts to which they were not prepared to extend their mains.

A Selby Water Supply Difficulty.—An unfortunate hitch, the *Yorkshire Post* states, has occurred in the Selby Urban District Council's scheme for supplying water to the urban area on the eastern side of the river Ouse. The work of laying the pipes in the bed of the river had been completed, and arrangements made for covering them with a bed of cement. On account of the heavy floods recently several of the pipes have been twisted and broken before the cementing process could be completed. This has necessitated about half of the line being taken out on the West Riding side, and the replacing work is likely to be considerably delayed.

Hot Water in Corporation Tenements.—At a special meeting of Greenock Corporation recently, the question was debated as to whether there should be an installation of hot water in the municipal tenement houses to be built on the Roxburgh-street site. The Housing Committee reported in favour of hot water by six votes to five, and the recommendation was submitted to the council. Provost M'Millan, who moved an amendment, said that no member would sooner see hot water in the houses than he, but the installation would cost £4 15s. per house, and it was impossible to guess where extras would stop. Dean of Guild Paterson, who seconded, said that a kettle would do better than what was proposed. The amendment was carried by the casting vote of the Provost.

Municipal Work in Progress and Projected.

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The following are among the more important projected works of which particulars appear below: Buildings—Dumbartonshire, Hampshire; housing and town planning—Greenock; refuse collection and disposal—Easington, Eye; roads and materials—Rotherham; sewerage and sewage disposal—Bolton, Matlock; water, gas and electricity—Margam. Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Brailes R.D.C.—The tender of Mr. Busker, Kineton, at £123, has been accepted for rebuilding Shipton Bridge, Butler's Marston.

Chatham T.C.—The council have approved the plan prepared by the borough surveyor, Mr. C. Day, for a public convenience on corporation land in Fair-row, and have instructed him to proceed with the work.

Clowne R.D.C.—It has been decided to provide a public convenience near to the Midland Railway Station.

Dumbartonshire C.C.—Negotiations are proceeding between the county council, the town council of Clydebank, and the town council of Dumbarton, for the erection of a joint consumptive sanatorium for the purposes of the three local authorities.

Hampshire C.C.—It has been decided to build a new school at Sholing, at an estimated cost of £9,540.

Littlehampton U.D.C.—The council have approved a plan and estimate for heating the new hospital buildings by radiation, and it has been decided that the sanction of the Local Government Board be applied for.

Lurgan T.C.—The Board of Works have agreed to issue to the council a supplemental loan of £1,200 for the completion of fifty-three artisans' dwellings in Wellington-street, at present rented by the military authorities. The original loan was for a sum of £10,000.

Renfrewshire C.C.—The members of the Upper District Committee of Renfrewshire last week inspected the new fire station which has been erected at Darnley in place of the buildings at Pollokshaws, which had to be vacated in consequence of the annexation of that burgh to Glasgow. The station, which was designed by Messrs. Robert Ewan & Sons, 101 St. Vincent-street, Glasgow, cost about £5,000. Accommodation has been provided for two motor engines and eight firemen. At present, however, only one motor engine and six firemen are necessary.

Sunderland T.C.—It has been decided to build a tuberculosis pavilion at the sanatorium.

Tyrone C.C.—The Tuberculosis Committee have been authorised to accept the tender of Mr. Isaac Copeland, Belfast, at £2,750, for the erection of a pavilion, and another tender, at £2,015, for alterations to Duncannon House.

HOUSING AND TOWN PLANNING.

Greenock T.C.—A sub-committee have at present under consideration a scheme for the provision of hut dwellings for the workmen engaged at the Royal Naval Torpedo Factory. It is suggested that accommodation could be provided for 500 persons, and that the needs of married couples as well as those of single men could be met.

REFUSE COLLECTION AND DISPOSAL.

Batley T.C.—A minute of the Sanitary Committee has been agreed to instructing the inspector of nuisances not to remove trade refuse from shops or business premises except in pursuance of a distinct agreement with the corporation for payment by the occupier of the shop of the reasonable costs incurred by the corporation in such removal.

Easington R.D.C.—It has been agreed to obtain information from other districts with respect to the cost of a dust destructor.

Eye T.C.—A decision has been reached to build a refuse destructor on the moors, the site to be left to the selection of the Public Health Committee.

Richmond (Surrey) T.C.—Negotiations have been opened up with the Barnes Urban District Council with a view to the provision of a joint dust destructor.

ROADS AND MATERIALS.

Castle Ward R.D.C.—It is proposed to carry out road improvements at an estimated cost of £1,500, towards which the Road Board have made a grant of £200.

Chatham T.C.—It has been agreed to pay £500 to the trustees of Watts Charity for land in front of two houses in High-street for the purpose of road improvement.

Dulverton R.D.C.—The county surveyor, Mr. E. J. Stead, has written to the council suggesting that during the next two months particular attention should be paid to patching and filling potholes on such lengths of road as were not intended to be recoated at an early date. The chairman (Mr. J. Tapp) said it was an excellent suggestion, and if generally followed throughout the county would result in a saving of thousands of pounds. The highway surveyor was instructed to carry out the suggestion.

East Suffolk C.C.—The clerk, Mr. A. T. Cobbold, at a meeting of the Roads and Bridges Committee, read the letter from the President of the Local Government Board urging the need for strict economy in all branches of public work. The chairman (Mr. Holt Wilson) said the county surveyor, Mr. W. Jervis, was alive to the necessity of economy, but he was met with the very great difficulty of having to keep the roads passable for the military. It was not really a question of studying the convenience of the public, but of studying the interests of the military. In the course of the proceedings Mr. Jervis warned the committee that there must be a due sense of proportion in the matter. They were in the danger zone, and their roads were being much more used than hitherto, and he warned them that if they depleted them of the necessary labour they would incur huge expenditure in the future for their repair. The clerk said he had much pleasure in reading a letter he had received from the chief engineer of the Road Board with regard to Mr. Jervis's services. The chief engineer, Mr. H. P. Maybury, said he was directed by the Road Board to express to their Highways Committee their keen appreciation of the valuable services which Mr. Jervis had rendered in connection with the construction and improvement of roads required by the military authorities. They were satisfied that the close attention which their surveyor had given had resulted in the works being carried out in an expeditious and economical manner, and, subject to the approval of the committee, the board would like to recognise the assistance given by making some monetary payment to Mr. Jervis. The chairman said that when he paid a visit to the Road Board's office for the purpose of obtaining an increased contribution towards road tarring, which proved futile, the desire was incidentally mentioned of the board to recognise Mr. Jervis's services, with the consent of the council. Mr. W. W. Hunt moved that the consent be given. Mr. H. F. Harwood, in seconding, said that it only showed what an efficient officer they had in Mr. Jervis. The motion was agreed to.

Erpingham R.D.C.—An agreement has been reached with the Road Board with respect to making up Gipsy-lane, Bodham, and part of the road from Bodham-street to Weybourne Station.

Hollingbourne R.D.C.—An instance of excessive zeal on the part of a councillor in connection with the supply of stone occurred recently. The surveyor, Mr. J. S. Roper, in reply to a question, stated that he was satisfied with the delivery of the stone (Bethersden marble). Where it had been inferior he threw it out. Upon this a councillor produced a sample of stone, and handed it to the surveyor, who thereupon stated: "I think it is very unfair to me, and they ought to know better than to pick up a sample and bring it here." The clerk: "The surveyor says,

"Unless I am satisfied that that sample came from the lump I have passed, I will not recognise it." It is only just to state that the councillor agreed with this point of view, adding that he wanted to be fair.

King's Lynn T.C.—The borough surveyor, Mr. A. J. Smith, has received instructions to repave South Everard-street.

Kiveton Park R.D.C.—Plans and estimates are to be prepared for the repair of the roads over the bridges of the Great Central Railway Company, and it has also been agreed to kerb in Rotherham and Pleasley main road.

Okehampton T.C. The council have approved the plan prepared by the borough surveyor, Mr. D. V. Howard, for widening Crediton-road.

Rotherham T.C.—A resolution has been adopted that the repair and maintenance of the track and permanent way of the tramways undertaking should be carried out by the borough engineer, under the direction of the Highways Committee, the cost to be payable by the Tramways Committee.

Totnes R.D.C. A motion has been carried to petition the county council to allow the local councils to reduce the quantity of stones on the main roads wherever possible, on account of the reduced traffic on the roads.

Westhampnett R.D.C.—The council have accepted the tender of Mr. Geo. Ewen, of Charles-street, Petersfield, to supply two 10-ton steam rollers, with scarifiers and water sprayers, for 24s. per day, and ½d. per square yard for scarifying during the year ending March 31, 1916.

Wilts C.C.—The council have approved a recommendation by the Roads and Bridges Committee with respect to the remuneration of assistant surveyors for supervising the repair of main roads requisitioned by the military authorities at the rates following: Up to £10,000 of expenditure, 2 per cent; from £10,000 up to £20,000 of expenditure, 1 per cent; for all expenditure above £20,000, ½ per cent. Mr. Colston explained that the Road Board had expressed a wish that assistant surveyors should be encouraged to expedite the work on the roads as much as possible, so that it might be completed before next winter. The recommendation was approved, the chairman explaining that the remuneration did not come out of the rates, but was a grant from the Government.

SEWERAGE AND SEWAGE DISPOSAL.

Basingstoke T.C. Application is to be made for power to acquire compulsorily land for the purpose of sewage disposal.

Bolton T.C. The question of extension at the Hacken sewage disposal works is being considered by the Cleansing and Sewage Committee.

Farnborough U.D.C.—It has been agreed to carry out storm-water drainage works, at an estimated cost of £140.

Llantarnam U.D.C.—The council have approved the plans of the surveyor, Mr. A. Gordon Jones, for a new sewerage system at Cwmbran, at an estimated cost of £556.

Lostwithiel T.C.—At a recent meeting of the town council the mayor expressed satisfaction at the way in which the borough surveyor, Mr. F. Knight, had carried out the new sewerage works. Not only had the work been done thoroughly, but it had also been done speedily.

Margate T.C.—It is proposed to take up a loan of £1,263 for works of sewerage.

Matlock U.D.C.—A deputation has been appointed to interview the Local Government Board with respect to the completion of the sewerage scheme, for which a sum of £12,000 is required.

Midsomer Norton U.D.C.—The surveyor, Mr. C. H. Sunderland, has received instructions to prepare a scheme for sewage disposal on the septic system.

St. Germans R.D.C.—With reference to the Crafthole sewerage scheme, Mr. R. H. Worth, engineer, wrote that the Local Government Board thought the council should give instructions for the extension of the scheme to other houses in the village, not now included in the scheme. Mr. Worth expressed the opinion that this would not add greatly to the cost of the scheme. It was decided that the representatives of Sheviock, the chairman, vice-chairman, clerk, and the engineer, should meet representatives of the Torpoint Council to come to an arrangement on the subject.

Sunbury U.D.C.—The council have been informed that at present the Local Government Board are not satisfied that there is any pressing need under the existing conditions for the expenditure of £900 on additional plant at the sewage outfall works.

Tavistock R.D.C.—A letter has been received from Lord Devon's agent stating that he was quite prepared to let his offer of the sale of land for sewerage purposes at Whitchurch remain open until after the war.

Westhampnett R.D.C.—The Local Government Board have written declining to sanction the borrowing of the balance of the loan of £4,400 for the purpose of completing the Felpham sewerage scheme, and the matter has been referred to the engineer to submit a report to the council.

WATER, GAS, AND ELECTRICITY.

Basingstoke T.C.—The council have adopted a scheme for the extension of the system of electric lighting.

Battle U.D.C.—A scheme for the filtration and aeration of the water supply is to be carried out, at an estimated cost of £150.

Blackburn T.C.—The Board of Trade have sanctioned the use of land at Whitebirk for the purpose of electricity works.

East Lothian C.C.—The council have sanctioned an additional expenditure of £200 in connection with the special water supply district of Innerwick.

Hertford R.D.C.—The scheme prepared by Messrs. Baldwin & Sons for a water supply for Bramfield has been approved by the council. The estimated cost is £1,500.

Leeds T.C. For the year ended March 31st the nett profit of the water undertaking was £51,493.

Liskeard T.C.—An estimate, at 8½d. per yard, has been accepted from the Eric Water Main Scraper Company for cleaning the 8 in. water main from the St. Cleer reservoir to Addington.

Margam U.D.C.—Negotiations are proceeding for the construction of new waterworks at Cilygovid, Duffryn Valley.

Torquay T.C.—In connection with the electricity undertaking, the Local Government Board wrote that they were prepared to sanction the raising of £1,577 and £3,518, being liabilities actually incurred, but that they proposed to defer issuing a consent order until it had been settled what other sums could be included. With regard to the loan of £5,000 for electricity mains, certain statistical information had, it was reported, been forwarded as well as some other particulars required by the board, and their further reply was awaited.

MISCELLANEOUS.

Barking U.D.C.—The acting surveyor, Mr. R. A. Lay, has been authorised to negotiate with the owners of certain properties with a view to the establishment of a municipal market.

Hove T.C.—The council last week decided to dismantle the electrical overhead equipment which was installed in part of the main thoroughfare about a year ago as an experiment to determine the system to be adopted in establishing the joint service of electric railless 'buses to be put on the roads in Brighton and Hove. In thus removing the posts and wires, the council will have to pay about £600 to the company which contracted to erect the plant, but this payment will be taken into account should circumstances in the future permit of a revival of the scheme. The two towns have mutually agreed to defer any further progress with the undertaking until after the war.

Newmarket U.D.C.—The surveyor, Mr. W. H. Ely, has been asked to obtain information with respect to the cost of a steam tractor.

Sixty Years of Sanitary Work.—"Sixty years of sanitary work and its effect on the incidence of tuberculosis" was the subject of a paper read recently by Mr. J. C. Dawes, chief sanitary inspector for Keighley, before a meeting of the North-Eastern Centre of the Sanitary Inspectors' Association, in Leeds.

PERSONAL.

Mr. M. A. Robinson, city surveyor of Londonderry, has had his salary increased by £200 a year.

Mr. J. M. Jackson, surveyor to the Downham Urban District Council, has had his salary increased by £15 a year.

Mr. H. A. Garrett, borough surveyor of Torquay, completed twenty-five years' service in that town on Saturday last.

Mr. F. Leslie Morrison, engineering assistant, Islington Borough Council, has joined the Royal Naval Air Service as an air mechanic.

Mr. R. G. Gurney, highways surveyor to the Ledbury Rural District Council, has applied for a commission in the Herefordshire Regiment.

Mr. G. C. Vernon-Inkpen, of Portsmouth, has been retained to prepare, for the Westhampnett Rural District Council, the plans for the proposed isolation hospital at Summersdale.

Mr. Edward Stead, ASSOC.M.INST.C.E., county surveyor of Somerset, has received a commission as Lieutenant in the Royal Engineers for service with the 4th Labour Battalion, and takes up his duties to-morrow (Saturday).

Mr. Alfred Price, ASSOC.M.INST.C.E., of the borough engineer's office, Eccles, has been gazetted to the 7th Lancashire Fusiliers as 2nd Lieutenant. He is the elder son of Mr. Arthur J. Price, the engineer and surveyor to the Lytham Urban District Council.

Mr. S. H. Chambers, surveyor to the Hampton Urban District Council, last week reported that several of his employees had been approached by a labour exchange with a view to their joining the pioneer section of the Royal Engineers, for trench digging in France, without military duty, and that he had been asked whether the council's resolution to allow half pay to workmen who joined His Majesty's Forces was intended to apply in the case of men employed upon non-military duties. The employees were informed that the resolution does not apply to such cases.

Mr. Prévost Hubbard has been appointed chief of the Division of Road Material Tests and Research in the U.S. Office of Public Roads, and has resigned as chemical engineer in charge of the Division of Roads and Pavements of the Institute of Industrial Research. Mr. Prévost Hubbard held the position of assistant chemist in the Office of Public Roads before joining the Institute of Industrial Research. It will be of interest to many of our readers to learn that the distinguished author of "Dust Preventives," published as Bulletin No. 34 in 1908, followed by the standard work "Dust Preventives and Road Binders," 1910, has returned to the U.S. Government Office as chief of the division.

In connection with the vacant town clerkship of Hackney, the *Hackney Gazette* says: "Rumour has it that, if the salary be sufficiently tempting, there is a possibility—indeed a probability—of the borough surveyor, Mr. Norman Scorgie, who is at present acting as deputy town clerk for the second time, offering himself as an applicant." The salary paid to the town clerk is £650 a year, and as borough surveyor Mr. Scorgie is in receipt of £800 per annum.

OBITUARY.

Mr. John J. Kelly, an inspector under the Irish Local Government Board, died suddenly last week, we regret to state.

Mr. Thomas Elliott, who for over a quarter of a century was surveyor of Enniskillen, died recently, we regret to learn, at an advanced age.

Mr. John Wedderspoon, sanitary inspector for Inverness-shire, died suddenly last week, we regret to state, in his sixty-fourth year. He had held the office for twenty-four years.

New Hampshire Asylum.—In connection with the new asylum at Park Prewett, Basingstoke, the Hampshire County Council have accepted the following tenders: Bakery, Messrs. Werner & Co., Peterborough, £986; kitchens, Messrs. Killick & Cochran, Liverpool, £2,619; laundry, Messrs. Summerscales, Limited, Keighley, £3,207; electric plant, Messrs. Hill, Upton & Co., Oxford, £15,489.

ROAD MAKING IN FLANDERS.

"AN ENDLESS PROBLEM."

[We make the following extracts from an article written by an officer in Flanders who was formerly a member of the London *Daily Express* staff. The article appeared in a recent issue of that journal.]

Last winter the Belgian Army was remodelled, and the veterans of the classes of the early 'eighties and the middle-aged but untrained volunteers were formed into Compagnies Travailleurs (working companies), and sent to the French and British Armies for general utility work.

They were employed on roads, and as roads are the basis of all modern strategy, these Belgian companies have played no unimportant part. As trench diggers and builders of field fortifications they have been indispensable.

Most of their work lies in an area that is well within range of the enemy's artillery fire, and at certain points is decidedly more unhealthy than the trenches themselves.

Until this war is ended, and the financial post-mortems have been held, no one will appreciate the vast amount of work that has gone to solve the road problems; but some day a schedule of figures in a Blue-book will express the results of our activity.

The road problem is endless, stupendous, and all-important, and is one that has to be tackled by special methods. Bright young field engineers come out from England dreaming of shiny steam rollers, water carts, supplies of macadam, and all the splendid panoply of an urban district council. They are promptly faced with an entirely new set of conditions, and learn the first lesson of the British Army, which is: "Whatever thou mayst desire thou canst not have it, but thou art at liberty to improvise."

"A WAR IN ITSELF."

Road making is a war in itself—a bitter and merciless war against circumstance and obstruction, against weather and local geographical conditions, against departments and authorities; and, in spite of all this, roads get repaired and built.

We have not the men, the materials or the time to build roads after the text-book manner, but a school of road repair has been evolved which converts a by-road into a boulevard by processes unknown to the county surveyor, but approved and practised by adaptable subalterns controlling vast gangs of civilians or the Belgian companies.

The effective repair of shell holes, the improvisation of drainage schemes, and wonderful systems of widening and banking corners—all are carried out with poles and faggots, hedge stakes and odd planks. Road metal and macadam are precious, and the already overburdened railroads cannot be cajoled into sending up more than an infinitesimal quantity. Motor transport cannot be spared, and caravans of slow country carts have to be organised and horsed from reserve transport and artillery units.

The enemy see to it that road work does not proceed without a due meed of artillery attention, and the flight of an aeroplane may be followed half an hour later by a brisk salvo of shrapnel.

The work itself is not unpleasant; in fact, compared to other jobs it is a country gentleman's life. But the day's mileage on a motor-cycle is more than one would ride for pleasure, and the infinity of detail to be attended to in two languages is absolutely amazing.

Progress is slow, and one road completed there is another to be done, each presenting individual problems and creating new demands. The job is essentially a thankless one, for no troops stay long enough in the same area to appreciate the work, and the labour passes unnoticed, and without reward other than the joy of accomplishment.

Cow in a Belfast Sewer.—A somewhat strange discovery was made by Belfast Corporation workmen on Tuesday afternoon, when they came across the carcase of a cow in an old river now used as the bed of a sewer. It is supposed that the animal fell into the water at the docks, and in its effort to escape drowning entered the outlet of the sewer, only to be suffocated on working up under the city. By means of a pair of shearlegs brought to the spot, where a large interested crowd of spectators had collected, the cow, showing signs of decomposition, was brought to the surface.

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING IN LONDON—(9).

On another page of this issue we publish a paper on

TAR, PITCH AND BITUMEN IN ROAD CONSTRUCTION,

which Mr. A. Dryland (Manager and County Surveyor of Sussex), presented at the annual meeting of the Institution of Municipal and County Engineers, held in London recently. The paper provoked an interesting discussion.

Mr. W. A. Farnham (Leeds City) said he strongly endorsed Mr. Dryland's remarks as to tar; the best surface dressing was crude tar. He was not one of the advocates of refined tar. He supported Mr. Dryland also in his observations with regard to coal-tar pitch. A neighbour of his some two years ago dressed a road with tar containing a liberal amount of pitch. At the same time he (the speaker) was working on an adjacent road with water-bound macadam. A traction engine with three trailers came along, and each wheel picked up something like half a ton of material off his neighbour's road and dropped it on his road, the result being that he was the happy possessor of an extra ton or so of macadam. That was one of his experiences of the value of enrichment. Proceeding to refer to the Sidcup experiments, Mr. Farnham mentioned first the Pitchmac section. That length, from his experience, had been fairly satisfactory, but he must point out that in the year the sections were laid the summer was an abnormally hot one, and the material had not been subjected since to such heat. The Tarmac sections were perhaps the best value for money of any on the road. In both cases they were tarred slag. The length of Trinidad carpeting was wearing admirably. The cost of that road was the second highest, but he thought the results would justify the expenditure. The conclusion he had come to was that the most expensive road for heavy traffic was the cheapest in the end. He wished to congratulate Mr. Chapman, the county surveyor, on the length of carpeting he had laid—granite chippings mixed with bitumen. This had been down for twelve months, and had a splendid surface, and the conclusion he drew from that was that the coming road would have to be a carpeting of rock asphalt.

Mr. E. Y. Harrison (Guildford) said it would be interesting to know the aggregate Mr. Dryland used. He knew that in most cases he was using slag, and so, as one could gather, slag was the only material surveyors could use with tar unless they went in for a very expensive road. They had had papers setting forth very clearly that slag macadam made a very good road, and they had some evidence of price, though that was very conflicting. He felt that a certain amount of care must be taken in this discussion of slag, because, though they might be satisfied as to its suitability for tar-macadam, there might be some difficulty in obtaining it, apart from which the quality was not always the same. Many of them would like to know from those who had used granite and found it successful something of their opinions, because they could not all make use of slag.

Mr. H. F. Gullan (Belfast) remarked that Mr. Dryland, in his observations on coal tar, entirely summed up his (the speaker's) experience when he said that whether a distilled tar or a water-freed tar only should be used in the production of tar-macadam depended on whether it was to be immediately used or stored. That was a very important point. Dehydrated tar was excellent if they stored the macadam; if they used it at once it was not so good. The question was, "What is a good tar; can we know a good tar when we get it?" Why he mentioned that was because not very long ago he was doing some tar-spraying, and he got three samples of proprietary articles and sent them to be tested along with some gasworks tar, and the result of the test was that all were very much the same standard, but did not come up to the Road Board specification. With regard to the use of slag, he had had no experience of slag, because they could not get it in Ireland, but he had been very successful with whinstone. They must have a good stone, and the tar compounds must be of a standard character. When they applied the tar, the material must be well screened, and then stored for three or four weeks before using on the road.

Mr. W. T. Haworth (Sheffield) expressed his agreement with Mr. Dryland as to grouting with tar and pitch. In no case did he find grouting equal to three-coat tar-macadam. The fault was that it was either too soft or too brittle, with the result that it peeled off, and the road went to pieces in the winter. He had found that by putting 3 in. of tar-macadam on the top of the pitch-grouting they got a satisfactory road. Several speakers had referred to the difficulties in obtaining slag, and asked if there was any substitute for it. They went in very largely for tar-macadam in Sheffield; in the last five years they had laid over 100,000 tons—nearly all slag. If the top coat was slag it did not matter what the bottom was. Where slag could not be obtained it was easier to get granite to settle if they used it for the top, but if used for the whole layer there was likely to be movement. He would like to give one point which had arisen out of his own experiments. They had laid tar-macadam on very steep gradients, and in the early days they got complaints about slipperiness, and he sprinkled the road with 1½ in. of slag and rolled it in, which stopped the complaints and had had the effect of holding up the tar in summer. It enabled the heat in the road to radiate, and got rid of that trouble altogether. There had been a reference to storage, and he liked, if possible, to store it, as it was better, if distilled tar, after a month's storage. Mr. Dryland asked for some standard of traffic, and Mr. Gettings was also strong about statistics. He would like to suggest to the president that they might get some accurate statistics as to the wear and tear of roads, also the tonnage, and if the president could help towards some standardisation of road statistics he would be doing a great service.

Mr. H. E. Stilgoe (Birmingham) observed that Mr. Dryland had drawn attention to the fact that in the construction of their roads it was necessary to consider the economy—that was to say, the class of surfacing and general construction necessary with due consideration and regard for the particular kind of traffic a road had to carry. On county roads, and similar roads where kerbs and channels did not exist, costs were very materially lower, inasmuch as it was possible often to put a coating of hardcore on the road, and then to put on the wearing surface. Of course, in some cases it was possible to put on a carpet on the top of an existing macadam road, assuming always that it was sufficiently strong and would carry it. Mr. Dryland had in his mind the re-carpeting work which he was carrying out so extensively. Mr. Dryland spoke of the subsoil and drainage and thickness and nature of road crusts, but he said very little about foundations. Those who had to reconstruct their roads in the towns found that before they could do the work they must, in many cases, take out the top and the bottom of the old roads and entirely reconstruct them. That was a very costly process. Some time ago, when he saw that Mr. Dryland was going to undertake this costly re-carpeting work at a cost of 3s. or 4s. per yard, he wondered whether he had roads of sufficient strength to do without reconstruction. Last year in Birmingham they used 1,500 gallons of coal-gas tar, and the tar they used was free from water and the light oils. That tar was used for the purpose of spraying the surface of macadam roads, and answered its purpose very well. With regard to the mixing of tar-macadam, one knew that much depended upon when the material was going to be used; twenty-five years ago they heated their stone in clamps, and then opened the clamps so that the pores of the stone could take the tar. They used to store their material for about six months, and it was all the better for that. On the question of pitch-grouted macadam, evidently that had not found favour in Mr. Dryland's eyes. They had laid considerable lengths of pitch-grouted macadam which had been very successful. It was important to see that the stone was not too small—the gauge at one time was 1½ in. to 2 in. The suitable gauge of the stone depended upon the quarry from which it came; a 2-in. stone from one quarry was equal to 2½-in. from another. They laid their pitch-grouted roads with 2½-in. to 2¾-in. Clee Hill stone, and their voids were not excessive. It might interest

their members to know that they could reduce the cost of the graded material by mixing it with one-third of good, dry, coarse sand made hot with the material in the boiler. Mr. Dryland had spoken of the minimum thickness of bitumen to be used on the surface as nearly 1 in. He took it that what he said there was a reference to an asphalt roadway laid upon concrete. With regard to carpeting, there again one had to draw a distinction between carpeting, as it could be applied to a road where there was no kerb or channel, and the resurfacing of a road by taking away the old surface.

Mr. C. F. Gettings (Worcestershire), alluding to Mr. Dryland's reference to the quality of the tar, said he did not quite understand to what extent he distilled his tar. He said "a good quality water-freed crude tar serves every necessary purpose, and in its penetrative power is superior to distilled tars." Most of them now—in fact, all of them—used dehydrated tar or a distilled tar, and it would be interesting information if Mr. Dryland would give them the analysis of the water-freed crude tar he referred to. To his mind many of them had taken all tars as being quite good, and from his own experience he had found, like the gentleman from Belfast, that it was absolutely necessary to take frequent samples and have them analysed, so that they should know exactly what their tar was. He was using a special plant for dehydrating. If they got tar from one particular works they could get a fair average sample, but the difficulty came in when they had to get a mixture from three or four different works. As he understood it, no gas engineer would give them a definite analysis from one week to another. Mr. Dryland's experience with pitch grouting had been very similar to many others, but he did not quite agree with him that it might be put down in towns where the traffic was quieter and it did not get the sun. His experience was that where it was cooler, and especially in narrow streets, it was very much more slippery. Mr. Stilgoe referred to pitch grouting. He thought, though he was not quite sure—Mr. Stilgoe would correct him if he was not right—that Mr. Stilgoe had used a proprietary article—not what they generally termed ordinary pitch and oil. He had seen some of Mr. Stilgoe's work, and knew he had got very good results. The difficulty with pitch grouting was where they had endeavoured to get a mixture of their own of pitch and oil mixed on the site. The manufacturers claimed that that was their advantage, and they could give them a consistent article, whereas if they mixed it themselves they were absolutely relying on their workmen to do that. As to the quality of slag, as he understood it, many steel works were laying themselves out to manufacture a standard of slag that practically guaranteed consistent quality, and he was informed there was little difficulty in doing that. He had had the pleasure of going over several of Mr. Dryland's roads, and one he would particularly refer to was the Brighton road, where Mr. Dryland had done a considerable amount of work. Mr. Dryland had done some very excellent work there near to Merstham, and he should be very interested to see what the results were. Mr. Dryland was working on the old road, which had some 5 in. or 6 in. of granite or gravel on it. Instead of putting his new material on the top of the surface, to save his cost he had scarified the top layer some 3 in. or 4 in. in thickness, and he had taken that material to his mixer without screening, and then he had added his pitch mixture to it and carted it back to the road. That material he had used for his base material, and on it he had laid a bitumen top. What struck him was the fact of Mr. Dryland being able to use his old material just as it came off the road. If that were successful it would be the means of saving a very large sum of money.

Mr. A. J. Lyddon (Essex), referring to the laying of tar material as done on the Merstham road, said they had done a considerable amount of that in Essex, and were able to get material on the road at temperatures varying between 120 deg. and 150 deg. That enabled them to use a good deal more pitch than by other methods. He believed the same was done on the Bath road; certainly it was done at Staines. On the subject of crude tar, he took it, in view of the circular from the Road Board, they were precluded from using it. They were asked to use refined tar. The product of crude tar was required for a more important purpose. It might be interesting to them to know that, in common with one or two other counties, they had laid a small area of Pitchfalt—a new material—and it was suggested that it overcame some of the disadvantages due to pitch itself. It had only been down a short time, so one could not say much about it. The minimum quantity of bitumen used had been spoken of. The experience they had of bitumen carpeting rather made them want to get the maximum of bitumen into the mixture, so that it might resist water action. They had laid a length of road in Essex on what to him was a novel principle. The bottom coat had been pitch grouted, and on the top of that they had laid another coat of tar-macadam that was put on hot. The appearance of that road after two or three months' wear left little to be desired. It overcame the disadvantages of pitch-grouted macadam. The thickness of the two materials was about 3½ in., and the cost came out at 3s. 2d. to 3s. 6d. per yard.

Mr. R. B. Holt (Leeds), in putting the question "What is slag?" remarked that they heard a great deal about bitumen and the other component parts of tar-macadam, but it seemed to him that any success achieved depended upon the slag. They had blast-furnace steel slag, which was divided into basic and open-hearth slag. If they followed up the proposal of Mr. Hadfield and had a committee they would soon arrive at better results. In Leeds they used a considerable quantity of basic steel slag with a composition of bitumen and oil, and the result was very satisfactory. Mr. Gettings referred to manufacturers turning out particular kinds of slag. That was a mistake. It was a by-product, and manufacturers were not going to turn them out slag if it was going to affect their iron or steel. They could, of course, keep the different kinds of slag separate, and he thought that if they had a committee to look into that it would pay them. There was little known about steel to-day, and there was far less known about slag. If they made an investigation into the slag roads that had failed, and found out whether they were made of blast-furnace slag, or basic steel slag, or open-hearth steel slag, they would be astonished at the result. Considerable quantities of open-hearth steel slag had been used in the North of England and in Leeds. In Leeds they had used a fairly large quantity grouted with Tarvia, and it was standing very well.

Mr. A. W. Ward (Shrewsbury) asked whether it was not a fact that the solution of the question of slag *versus* granite rested in the hands, not so much of the slag, as of the granite people? That meeting marked an epoch in the history of tar-macadam. The quarry owner could not but see the writing on the wall after that meeting. He had been conservative, and he had failed to have that expert advice as to the quality of his tar which he should have had. How many quarry owners did not use tar at all? Slag came along, it was a residual product, and the firms producing it had set themselves to work to see how they could improve their matrix. The engineer had regarded it from the point of view of its use, and not whether it was blast-furnace or basic or open-hearth slag. It lay in the hands of the tarred-granite producer to bring his matrix up to the standard of the best known slag makers.

Mr. J. W. Horton (Derbyshire) expressed the view that if the standard of matrix set for slag material was applied to granite it would be a failure. He did not think granite merchants had been so inactive as Mr. Ward said. He was pretty close to the Leicestershire granite quarries, and their owners had been experimenting on this question. The ordinary refined tar was practically useless as a binder for granite, and some of those quarries were now experimenting with a mixture of bitumen with granite, and he believed success would be found on those lines. He had himself put some tarred granite from those quarries on a road as a top dressing, and that at present was holding splendidly. He had every reason to believe it would be successful. If that proved to be the case then they would be able to use either limestone or one of the inferior slags for the bottom coat, and have on the top as wearing surface a smaller size granite bound with a better material which would take the wear. He did not agree that iron and steel manufacturers would make their slag to meet the wishes of road makers. Slag was a by-product, and they were not going to alter their manufacture of iron and steel for the sake of the slag they were making. Even a relatively poor slag was a better surface material than a limestone. Limestone would play an excellent part as a bottoming material, but as a top wearing coat it was inferior. Therefore he was of opinion that slag was the better material for wearing. He was hoping before their next annual

meeting they would have in the market a granite that would be suitable, and give them the surface coat of the kind they required.

Mr. W. H. Grieves (Sutton, Surrey) agreed with Mr. Dryland that it was absolutely essential to have a sound base. Another essential point was that they must have something to prevent the lateral thrust of this bituminous carpeting. Mr. Dryland had adopted a submerged kerb which he had copied to a limited extent. It was a most excellent method to prevent the lateral thrust. As to Mr. Dryland's statement "that while an inch is probably nearly the minimum thickness at which it can be laid to give an extended life, no great advantage will be gained by any considerable increase beyond that thickness," he thought he was right in saying that Mr. Dryland did not intend that to be on a concrete foundation, but on an ordinary macadam road. In a subsequent paragraph of the paper Mr. Dryland said "the author has had the most excellent results from bituminous carpets 1 in. only in thickness on a water-bound macadam base." That was very possible. But in this carpeting work everything depended upon the carefulness with which every item was done. Every care must be exercised by the men, or else they might get a failure, as some of them had experienced at the present time. The temperature, the exact quantities of material were all important factors in the success of the work.

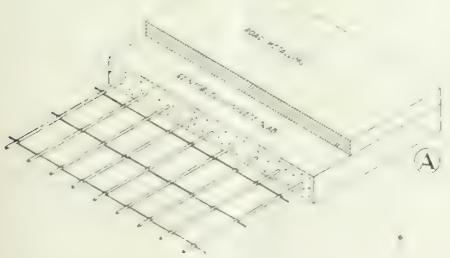
(To be continued.)

REINFORCED CONCRETE ROAD FOUNDATIONS.

A new system of road reinforcement is being introduced by the Loop Road Reinforcement Company, of 663 Caxton House, Westminster, S.W., and has, we understand, already been adopted by the War Office, and approved by the Road Board, for a military road in the Isle of Ely and the county of Cambridge.

From a booklet which has been issued by the firm we gather that the Loop reinforcement is supplied in convenient lengths for threading together on the site, and can be applied in various positions in the concrete to obtain the highest results.

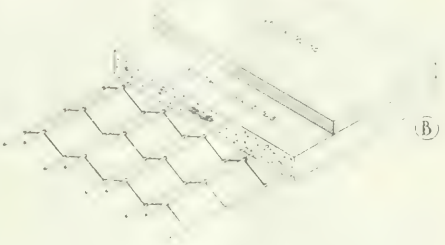
The booklet points out that if the resistance of the subsoil varies, and is not capable in parts of sustaining any appreciable load, the slab is called upon to distribute the load across this span by its resistance as a beam if the span is appreciable, or by



shear if the span is short; also to resist the rolling-out action of advancing load. "This beam action," it is added, "due to the fact that the slab is continuous, requires the slab to have tensional strength both in the top and the bottom, and any arrangement of slab which does not provide for this is neither efficient nor economical, as the steel is not worked to the best advantage."

Loop road reinforcement can be laid flat in the centre of slab, if desired, where the subsoil resistance is good, as shown by Fig. A. But a reinforced-concrete bed, 6 in. thick, of 6 to 1 Portland cement concrete reinforced as shown by Fig. B, with steel top and bottom, is much stronger than A, and prevents fracture of the slab through shear due to heavy concentrated load, the steel taking up the shear and distributing the load over a large area of slab, so reducing the ground pressure, the tendency to local subsidence, and ultimate disintegration from this cause.

Further additional strength is obtained in the slab by laying the main reinforcement top and bottom, and at an angle of 45 deg. inclined from the centre of the road longitudinally, as shown in Fig. C. By this means the longitudinal strength will be slightly reduced—that is to say, approximately in the proportion of 19 to 23—whereas the cross-sectional strength of the road will be increased from approximately 4

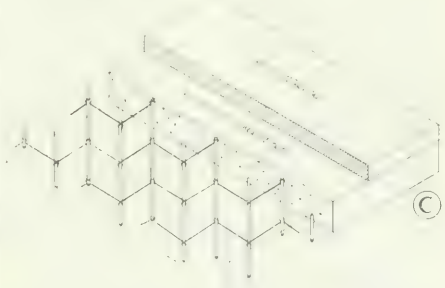


to 19. The strength of the road, if carried out in this manner, will be equal in every direction under all traffic.

The following advantages of efficiency are claimed to be obtained in the Loop system of reinforcement as applied to road foundations:

(1) Provision for shear due to heavy concentrated loads.

(2) Distribution of heavy loads over a large area



of ground surface, and consequent reduction of tendency to local subsidence.

(3) Resistance to damage due to rolling-out action of advancing load.

(4) Reinforcement easily handled, adapted to any width of road and can be laid in half-sections.

(5) Considerable economy over plain concrete slabs of greater thickness—that is to say, a 6-in. Loop reinforced-concrete roadbed is stronger and cheaper than 9 in. of solid concrete.

(6) No liability of reinforcement to become displaced when concrete is put in position.

(7) Can be efficiently reinstated after trench opening.

"B.R.C." Road Beds.—The British Reinforced Concrete Engineering Company, Limited, 1 Dickinson-street, Manchester, have issued two new leaflets which should be of interest to road and tramway engineers. One of these illustrates their well-known system of reinforcement as applied to ordinary highway work, and the other the application of the "B.R.C." fabric to tramway tracks. Both are tastefully produced.

Test of Fire-resisting Glazing.—The British Fire Prevention Committee have issued as "Red Book" No. 198 the report of a fire test with three window openings filled with wired glass, which were subjected to the committee's standard sixty-minute test at temperatures reaching up to 1,600 deg. Fahr., followed by the application of water under pressure. While as a rule the committee's standard tests for glazing are with glazing panels measuring about 2 ft. by 2 ft., one of the panels under test in this case measured about 3 ft. by 2 ft.—*i.e.*, was of a size materially in excess of the present maximum size generally allowed for fire-resisting glazing.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. H. T. Wakelam, M.Inst.C.E., County Engineer of Middlesex.

EASTERN SUB-DISTRICT (NORFOLK, SUFFOLK AND CAMBRIDGE).

Mr. Robert Croome, the engineer and surveyor to the Cromer Urban District Council, has arranged to have a sub-district meeting at Cromer to-morrow (Saturday).

Programme.

12.30 p.m.—Meet at council offices, where Mr. D. Davison, J.P., C.C., chairman of the Cromer Urban District Council, will receive the members.

Read minutes of previous meeting.

Discuss "How to put more life into the Eastern Sub-District," which subject will be opened by Mr. R. Croome.

1.30 p.m.—Lunch at the Hotel Metropole. Tickets 2s. 6d. each.

2.30 p.m.—Discussion on "Road Tarring," which will be opened by Mr. R. Croome, who requests that, as far as possible, each member present will state his experience and give cost where possible per square yard.

4.30 p.m.—Afternoon tea at "The Warren," by kind invitation of Mr. F. H. Barclay, J.P., chairman of the Highways Committee. Mr. Barclay will be pleased to show members the gardens after tea.

Either before 12.30 or after tea visits will be arranged to the storeyard, electric light works, fire station or destructor, if the members desire.

J. R. Mead, *Hon. Sub-District Secretary*, Ipswich.

H. T. Wakelam, M.Inst.C.E., *District Chairman*, Middlesex.

It is hoped to be able to arrange with Mr. W. Lionel Jenkins, the county surveyor for West Suffolk, to have a sub-district meeting at Bury St. Edmunds in the near future.

ROYAL SANITARY INSTITUTE.

PROVINCIAL SESSIONAL MEETING, BRIGHTON.

A sessional meeting will be held on Friday and Saturday, September 3rd and 4th, in the Permanent Art Gallery, Brighton, at 10.30 a.m., when discussions will take place on "Indian Sanitation," "Camp Sanitation," and "The Final Report of the Royal Commission on Sewage Disposal."

The chair will be taken each day at 10.30 a.m. by Sir Henry Tanner, C.B., I.S.O., F.R.I.B.A. (chairman of the council of the institute). Vice-chairmen: H. Percy Boulnois, M.Inst.C.E., Louis C. Parkes, M.D., D.P.H., Colonel J. Lane Notter, M.A., M.D., R.A.M.C.

Tickets for admission of visitors may be had on application to Dr. Duncan Forbes, medical officer of health, Town Hall, Brighton, who is kindly acting as the local hon. secretary of the meeting; and of E. White Wallis, secretary.

Programme.

Friday, September 3rd.

10.15 a.m.—His Worship the Mayor (Alderman J. L. Otter, J.P.) will welcome the members of the institute to Brighton.

10.30 a.m.—Discussion on "Indian Sanitation."

1—"Sanitary Problems in Hospitals for Indian Troops in England," by Major S. P. James, M.D., I.M.S., the Kitchener Hospital, Brighton.

2—"The Use of Storm-water Drains to Ensure Safe Water Supplies being Obtained from Polluted Catchment Areas," by Major C. C. Murison, I.M.S., staff officer, the Kitchener Hospital.

12 noon.—Discussion on "Camp Sanitation" to be opened by Lieut.-Colonel H. R. Kenwood, M.B., R.A.M.C.

2.30 p.m.—Visit to the Kitchener Indian Hospital. The party will assemble at the North Gate of the Royal Pavilion, close to the library, and will proceed by car.

3 p.m.—Visit to the Royal Pavilion Indian Hospital. The party will assemble at the North Gate of the Royal Pavilion, close to the library.

8.30 p.m.—Reception by his Worship the Mayor at the Permanent Art Gallery.

Saturday, September 4th.

12 noon.—Discussion on "The Final Report of the Royal Commission on Sewage Disposal" to be opened by Samuel Rideal, D.Sc., F.I.C., and J. D. Watson, M.Inst.C.E. (engineer to the Birmingham, Tame and Rea District Drainage Board).

2.30 p.m.—Visits will be made to Shoreham Camp and the Brighton electricity works.

STUDENTS' LECTURES.

The fifty-ninth course of lectures and demonstrations for sanitary officers will commence on Monday, September 20th.

Wednesbury Housing Scheme.—Wednesbury Town Council have been placed in a difficulty by the refusal of the Local Government Board to sanction a loan for the erection of twenty-four workmen's dwellings, as proposed in a housing scheme adopted by the corporation. Prior to the decision of the department having been received, the work had been placed in hand, and an alternative application was accordingly made for the department to permit the council to purchase eight houses which have been erected by the contractors. They have, however, now received a reply which is to the effect that the board regret that, owing to the prevailing conditions, they are unable to sanction the application.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SURVEYOR, INSPECTOR AND COLLECTOR.—August 23rd.—Buckfastleigh Urban District Council. £150 a year.—Mr. E. Windeatt, clerk, 19 High-street, Totnes.

SURVEYOR.—August 23rd.—Halesowen Rural District Council. £160 per annum.—Mr. E. H. Grove, clerk, Church Steps House, Halesowen.

SURVEYOR AND INSPECTOR.—August 23rd.—Hunsworth Urban District Council. £100 per annum.—Mr. P. O. Ashworth, clerk, 14 Piccadilly, Bradford.

SEWAGE WORKS ENGINEER.—August 24th.—Corporation of Bedford. £2 10s.—£3 per week, with house.—Mr. N. Greenshields, borough engineer and surveyor, Town Hall, Bedford.

MECHANICAL ENGINEER AND FOREMAN.—August 24th.—Corporation of Bedford. £2 10s.—£3 per week.—Mr. N. Greenshields, borough engineer and surveyor, Town Hall, Bedford.

PERMANENT WAY FOREMAN.—August 28th.—Corporation of West Ham. £3 5s. per week.—Mr. J. S. D. Moffet, general manager, Tramway Offices, Greengate-street, Plaistow, E.

FOREMAN PLATELAYER.—August 28th.—Corporation of West Ham. £2 5s. per week.—Mr. J. S. D. Moffet, general manager, Tramway Offices, Greengate-street, Plaistow, E.

ASSISTANT ENGINEER.—August 28th.—Corporation of West Ham. £250 per annum.—Mr. J. S. D. Moffet, general manager, Tramway Offices, Greengate-street, Plaistow, E.

SURVEYING ASSISTANT.—August 28th.—Corporation of West Ham. £117—£120 per annum.—Mr. J. S. D. Moffet, general manager, Tramway Offices, Greengate-street, Plaistow, E.

CHIEF STOREKEEPER.—August 30th.—Corporation of Birmingham. £156 per annum.—Mr. Henry E. Stilgoe, city engineer and surveyor.

INSPECTOR OF NUISANCES.—August 30th.—Uxbridge Urban District Council. £150 per annum.—Mr. W. T. Harvey, clerk, 63 High-street, Uxbridge.

BOROUGH SURVEYOR.—August 31st.—Deptford Borough Council. £450 per annum.—Mr. A. Purkis, town clerk.

The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

Fire Brigade Organisation and Equipment.

By many of the smaller local authorities the surveyor is also expected to fill the position of chief of the fire brigade, and the paper on "Fire Brigade Organisation and Equipment," read by Mr. W. A. Farnham at the annual meeting of the Institution of Municipal and County Engineers, is therefore likely to prove very useful and interesting to many surveyors. Fire brigade organisation is somewhat outside the scope of the borough surveyor's work in a large town, and even in many towns of a fair size, when a separate fire engineer is not appointed, the work falls to the chief constable rather than to the borough surveyor. While the chief constable generally has great organising power and is a good disciplinarian, he has not the knowledge of building construction, mechanics, or hydraulics that the borough surveyor possesses, and so in the case of the smaller local authorities the work frequently falls to the surveyor as being the official most suitable for the post. No legal obligation is imposed on local authorities to provide or maintain a fire brigade, and many authorities take advantage of this and leave the brigade to be equipped either by voluntary effort or by the large fire insurance companies. In too many cases where the local authority provides the equipment the appliances are of an obsolete or useless character. In the case of many rural authorities no attempt is made to provide any brigade, and they frankly rely on the good feeling of their better-equipped neighbours in the urban districts prompting them to come to the rescue in case of fire in the rural district. Even when this is done we frequently find that they object to pay for attendance at the fire, or dispute the bill for the service rendered.

In order to get over these difficulties and to place matters on an equitable footing, Mr. Farnham suggests that the county council should be responsible for fire protection as they are now for the police. The county authority would provide the funds for equipment and maintenance of the brigades, divide the county into fire areas, with the rural areas served from the most convenient urban centre, and so that all centres should be in telephonic communication and assist each other when necessary. In the case of districts with populations under 20,000, he suggests that where possible the municipal offices, fire brigade station, and depot should be grouped together. This would enable one of the permanent workmen—say the road foreman—to reside on the premises and act as superintendent of the fire brigade after working hours. During the day another employee could act as fireman, office caretaker and storekeeper, and there should be a number of men retained to act as firemen. These retained men need not be employed solely on the work of the council, but may be engaged as mechanics, labourers, or small shopkeepers in the district, but still give the council the first claim on their services in case of fire.

The paper contains much useful information with regard to the design of fire stations, alarms, and call bells. The alarms, in Mr. Farnham's opinion, are the most important part of the brigade's equipment, and they should be reliable under all circumstances, and especially be free from line or instrumental faults. To avoid defects in the line there should be a system of duplicate wiring, and provision should be made for both visual and audible indications of earths or line shortages and their causes and approximate position. Telephonic connection should be provided between the station and men's residences. The traction should be mechanical, and a choice may be made from electric, steam or petrol driven motors. Electricity is generally useful only in large towns where the accumulators can be charged conveniently. Steam, though reliable and economical in running, has the disadvantage of taking up precious time in raising it sufficiently to get under way. The petrol motor is generally the most suitable. It is reliable, simple to handle, and can be driven by a novice. Mr. Farnham prefers petrol-driven pumps to either steam or electric pumps, on account of the ease with which petrol can be obtained. In the majority of cases he considers the turbine is the best form of engine, though the form of engine best suited for the purpose is largely a question of local conditions. Except where there is an exceptionally large water supply he does not favour pumps of too large a capacity, and is of opinion that 220 gallons per minute is ample for most small towns, though this opinion was not shared by other members who took part in the discussion on the paper.

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The Return as to Water Undertakings.

In our last two issues we have dealt shortly with the historical parts of the introduction to the recently issued Parliamentary return as to water undertakings in England and Wales, and we now propose to make some comments on the return itself. It will be

remembered that it is divided into two parts, the first of which gives particulars of every water undertaking in England and Wales, while the second shows how each district or parish is supplied with water. The first thing which strikes us is the comparatively large number of undertakings owned by local authorities, many of them being of a most important character. This is so far satisfactory, but it is a matter for regret that the principle of the combination of small neighbouring districts has not been more widely adopted. The joint authorities are generally composed of representatives of local authorities combined for the purpose of supplying water to the districts of the authorities represented, but county councils and other public bodies are also represented on the Metropolitan Water Board and the Derwent Valley Water Board. The local authorities represented on joint boards and joint committees for supplying water are the councils of the twenty-nine metropolitan boroughs, ten county boroughs, twenty-three other boroughs, seventy-eight urban districts, and twenty-five rural districts. Apart from the Metropolitan Water Board, the largest joint undertakings are the Tees Valley Water Board, which distributes 15,000,000 gallons daily, and the Derwent Valley Water Board, which supplies just over 10,000,000 gallons daily in bulk to its constituent authorities for distribution by them. Besides the three boards mentioned there are only fourteen other joint authorities, each of which supplies over 500,000,000 gallons daily. It is not possible to say what portion of the country is supplied municipally and what portion by companies, chiefly because some districts are supplied by more than one undertaker. Birkenhead, for instance, is supplied partly by the town council and partly by the Wirral Company. And in some cases local authorities distribute supplies obtained in bulk from companies, and *vice versâ*. From the particulars given it seems likely that about two-thirds of the total population of the country is now supplied with water by municipal bodies, and that only a few million of the inhabitants of England and Wales depend on unpiped supplies.

It appears clearly from the return that the general powers given by the Public Health Act are insufficient in most cases to enable local authorities to undertake the schemes necessary for supplying their districts with water and to carry on their undertakings in accordance with their requirements, so that it is frequently necessary for them to have recourse to local Acts. The cost of obtaining a local Act is often considerable, even where the Bill is not seriously opposed, and much in excess of the cost of proceeding under the general law. The cost of a Provisional Order under the Public Health Act, or of proceedings under the provisions of that Act relating to water supply, is usually trifling, being limited in most cases to the expenses attendant upon the local inquiry which is held by the Local Government Board into the application for the Provisional Order or for the loan for the carrying out of the works of water supply, as the case may be. Of course, if a Provisional Order had to be supported against opposition in Parliament the cost might approach much more nearly to that of a local Act. The fact that all the county boroughs with water undertakings have obtained local Acts affords evidence that the powers of the Public Health Act in this matter have not sufficed, at any rate for the larger schemes.

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Engineering and Road Making in the Trentino.

The operations of engineers in war are, of course, indispensable, but nowhere have their skill and daring been displayed to better advantage than in the campaign of the gallant Italians in the Trentino area. A vivid description of the work of the Italian engineers and road makers in this mountainous region has been sent home this week by Mr. W. T. Massey, the correspondent of the *Daily Telegraph*, and judging from this it would seem that something like a record has been established by our Ally. Here and there, we are told, the tasks of the engineers seemed almost insurmountable, but the whole army was out for a precedent in military history, "and whatever stands in the way must be broken down." Roads blown up by the Austrians in retirement were speedily repaired, and while Bersaglieri and Alpini held all the approaches the engineers went forward to make the positions secure. Whenever the situation demands the occupation of a summit, the engineer comes in and cuts a road for mule and muleteer. "Sometimes," says Mr. Massey, "the obvious route is denied him because it faces the enemy, and he has to choose a line the difficulties of which would appal anyone not endowed with the optimism of the Italian military engineer. They are not short paths. I have seen roads cut out of rock on mountains rearing lofty heads 7,000 ft. above sea-level. In one place, which shall be nameless, an Alpini relief column proceeding to the relief of a detachment in trenches only 300 metres distant from Austrians took three hours and a-half on the journey, and Alpinis do not hesitate on the way. Miles of that ziz-zag road were cut in two months, and it is so banked that it looks as if it would last for ever. Up this path, some parts of which are very precipitous, mules carry water, cement and other secure 'consolidators,' and rations, and one splendid animal I saw had on its back in two double-lined tanks the hot cooked meat and soup rations for sixty men." There is no thought of any labour proving fruitless. There is one hill possessing a winding, stony track which is the pride of the designer. It is hidden from the enemy as completely as any work could possibly be. An instance is recorded of a pass which had been blown up by the Austrians where the resourceful Italian engineer "put a cement foundation upon the irregular surface caused by the firing of three mine chambers, and upon it was erected nine days after the declaration of war a bridge capable of carrying the heaviest traffic it is likely to be asked to bear—that is saying much." All of which would appear to justify the comment that truly the Italian engineer is master of his art, and yet he is but a type of the army.

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The Road Board Report.

In accordance with the provisions of the Development and Road Improvement Funds Act, 1909, the fifth annual report of the Road Board has just been issued. It contains not only an account of the ordinary work of the board, but also a description of the steps taken to deal with the difficult questions that arose on the outbreak of the war. The experience gained in former years has confirmed the board in their opinion that the most pressing and the most universal need is the strengthening and improving of the crusts of existing roads, and by far the greater part of the funds available has therefore been devoted to this work. Even so the situation is not being fully met, for the report states that the great increase of heavy motor traffic on many miles of road in many districts, and the difficulties which the highway authorities have found and will continue to find in maintaining their roads in water-bound macadam, point to the conclusion that practically the whole of the funds at the disposal of the board will be required to assist the reconstruction of the heavily trafficked highways of the country, with the result that unless some additional source of assistance from national funds towards that inevitable work of reconstruction can be found, schemes of new road construction and of road widening on any extensive scale will probably

[illegible] indefinitely. Unfortunately, the abnormal traffic conditions set up in many districts by the outbreak of war rendered it necessary to suspend for the time being the classification of roads which had been undertaken as a preliminary to suggested changes in the system of distribution of Imperial revenues in aid of local taxation. On the other hand, however, the war has thrown much work of a special character on the department, largely in the direction of making preparation for the execution of necessary works in areas in which abnormal distress might arise. In addition to this the board undertook, at the request of the Army Council, to arrange for and supervise the construction and improvement of roads required for military purposes, the cost of the latter work alone amounting to nearly £500,000 sterling. The report, which also contains much statistical information, forms a record of the work of a strenuous and abnormal year.

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The Aberdeen Water Scheme.

There appears to be some dissatisfaction in the minds of certain of the citizens of Aberdeen in regard to the proposals of the town council to provide the city with an adequate supply of pure and wholesome water. The water question has been the most debated topic in local politics for a long time past, the controversy having turned mainly upon whether the supply should be drawn from the Dee or the Avon. Two elections have been fought on this question, and as a result a Provisional Order has been obtained providing for the water being drawn from the former river. The Bill for the confirmation of this Order is even now before Parliament, and it really seemed as though the question was about to be settled once and for all. At the last meeting of the city council, however, something in the nature of a bombshell was sprung upon the assembly by the presentation of a petition from a number of prominent citizens, in which it was suggested, even at this stage, that a new and independent estimate should be obtained for a supply to be drawn from the river Avon. The city treasurer, in a convincing speech, moved: "That having regard to the fact that the council had already obtained a report on the river Avon from the engineers—Mr. Roberts and Mr. Hogg—and that the points referred to in the memorial have already been fully considered, and having also regard to the advanced stage which the application for a Provisional Order in connection with the river Dee has now reached, the council are of opinion that they would not be justified in withdrawing the application and entering upon a further investigation of the nature indicated in the memorial, and resolve that a reply to this effect be returned to the memorialists." After a discussion, in which some support was accorded to the petitioners, the motion of the city treasurer was carried by a very large majority.

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The War and Road Maintenance.

At the last meeting of the Northumberland County Council the annual report of the county surveyor was presented, and in it attention was drawn to the difficulties which have occurred in the work of road maintenance since the beginning of the war. The extraordinary shortage of labour has been responsible for the abandonment of much of the work which would have been undertaken during the year in normal times, while much delay has been caused in the completion of that which it was found possible to do. Moreover, the report states that there is little hope of any improvement in road surfaces during the war. On the other hand, the work of providing foundations is being continued in pursuance of the wise policy adopted by the council of executing works of permanence as far as possible. In these circumstances it is hardly surprising to learn that in Northumberland the roads have shown no signs of improvement over their condition of the previous year, and that it will be a difficult matter to keep them up to their present standard of efficiency without a heavier outlay. This is the general experience, but, as we have recently pointed out on more than one occasion, there is considerable danger of false economy in this matter of highway maintenance. In applying the principle that only necessary work should be undertaken at the present time care must be taken lest the future is unduly mortgaged by suffering undue deterioration to take place. It is not in this way that ultimate saving will be achieved.

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Wiltshire Main Roads.

At the last meeting of the Wiltshire County Council a most interesting report dealing more particularly with the special work that is being carried out on the main roads in the military area was presented by the Roads and Bridges Committee. About 90 miles of roads in all are affected, and about 4,000 tons of metal are being used each week. It will readily be understood that it is no easy matter in these days to secure such a quantity of material, even for work of urgent national importance, and a necessary corollary of the heavy demands made by the military authorities is the comparative starving for the time being of other roads in the county. In a great many places these are being patched, and their condition is not all that could be wished for. Road users will no doubt be ready to exercise considerable patience, realising as they must the extreme urgency of the national requirements and the consequent difficult conditions under which the county council have to carry on their ordinary work. In the course of his speech the chairman of the committee referred to certain criticisms which had been made as to the heavy expenditure on the roads, and said that he could not admit that the work had been extravagantly done. Apparently, in Wiltshire as elsewhere, there are certain critics who still have to be taught that present saving on highway work is an utterly extravagant policy if it involves the abandonment of necessary work.

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Housing in Johannesburg.

It appears from the last annual report of Dr. Charles Porter, the medical officer of health to the Municipal Council of Johannesburg, a copy of which has been courteously sent to us, that the difficulties in the way of dealing with slum property in the city are almost insuperable, owing to the present state of the law in the Colony. Unfortunately, there is in existence neither a comprehensive Public Health Act nor a good Town Planning Act, so that the council are quite without the necessary powers to deal either with the problem of slum clearance or with that of the housing of the native population. Moreover, attempts to deal with these matters under the existing powers to make by-laws have been rendered largely abortive owing to adverse decisions of the courts. The by-laws at present under consideration are based upon the procedure prescribed by those sections of the English Housing, Town Planning, &c., Act, 1909, which deal with the closing and demolition of houses unfit for human habitation, except that there is no appeal from decision of the council to any higher authority corresponding to the Local Government Board. The medical officer of health has suggested that there should be such an appeal to the Department of the Interior, or to His Honour the Administrator, but to create an effective appeal of this kind legislation is required.

The Disposal of Liquid Wastes from Manufacturing Processes.

CRITICISMS OF SEWAGE COMMISSION'S RECOMMENDATIONS.

By H. MACLEAN WILSON, M.I.C., B.SC., Chief Inspector, and H. T. CALVERT, M.SC., PH.D., F.I.C., Chief Chemical Assistant to the West Riding of Yorkshire Rivers Board.

[This important report, issued this week, has been prepared for the information of the West Riding Rivers Board, and is of particular interest in view of the forthcoming meeting of the Royal Sanitary Institute, at Brighton, at which the final report of the Royal Commission will be discussed.]

The Ninth Report of the Royal Commission on Sewage Disposal deals with two important branches of the work of the board, the disposal of liquid wastes from manufacturing processes, and the disposal of liquid and solid domestic refuse in rural areas.

The commission have attacked the problems dealt with in their usual comprehensive and effective manner, and it is a pity that, as they recognise, they have not been able to devote sufficient time and attention to the large questions in view. It may be permitted to say that this report is much more readable and better arranged than many of the previous, and shows the great pains which the commission and their officers have been at. If it is necessary to criticise their recommendations somewhat stringently it must be taken as an acknowledgment of the importance and weight of their opinions.

This report recapitulates the recommendations of the Third Report that it should be the duty of the local authority to provide such sewers as are necessary to carry trade effluents as well as domestic sewage, and that the manufacturer should be given the right, subject to the observance of certain safeguards, to discharge trade effluents into the sewers of the local authority if he wishes to do so. (Third report, par. 22.)

In the Third Report it was also recommended that where a manufacturer complies with the regulations of a sanitary authority for the preliminary treatment of his trade refuse he should, generally speaking, not be required to pay for its disposal. The commission now, however, report (par. 10) "that it may be desirable that local authorities should have a general power to make a charge, provided that the charges were lower in the case of effluents which had been subjected to preliminary treatment in accordance with the regulations."

The necessity is emphasised for the formation of Rivers Boards throughout the country and of a central authority with a staff of experts, one of whose functions would be that of "discovering the most efficient and economical means of treating the different classes of trade liquids."

They say (par. 32) with regard to some trade waste liquors that they have not found it possible to purify them at reasonable cost, whereas the Commission of 1868 reported (First Report, p. 96) that—

> "of the many polluting liquids which now poison the rivers there is not one which cannot be either kept out of the streams altogether, or so far purified before admission as to deprive it of its noxious character, and this not only without unduly interfering with manufacturing operations, but even in some instances with a distinct profit to the manufacturer; and even in those cases where a certain amount of expense must be incurred in unremunerative operations, the use of the purified stream will more than recompense this expenditure."

In this report the commission mainly deal with cases where, for one reason or another, the "manufacturers must remain responsible for the treatment of their own trade liquids." They describe different liquid wastes, the processes by which they may be purified, and the standards with which in the opinion of the commission the purified effluents ought to comply, classifying the liquid wastes in three groups:—

(1) Those which are polluting by reason of the suspended matter which they carry with them;

(2) Those which are polluting mainly because of the suspended matter which they carry with them, but also to a considerable extent because of the dissolved impurities which they contain; and

(3) Those which are polluting mainly because of the dissolved impurities which they contain.

They have investigated the results obtained by means of the purification plant in existence at various mills, and apparently in only two or three instances are their conclusions based on their own experiments. The information given with regard to the treatment of trade refuse is not nearly so complete as that given with regard to the purification of sewage in former reports, and would not indeed be of much service to a manufacturer who desired to construct works for the purification of his refuse. They state that they can only indicate the lines on which the appropriate solutions should be sought (par. 12), and that further time and experiment are necessary for the elucidation of the subject.

In the concluding part of this section of their report the existing law in regard to manufacturing pollution and its defects are discussed, and suggestions are made for its amendment. The most important of these is the suggestion that a system of legal standards should be set up, and the commissioners discuss the basis upon which such standards are to be founded. It is to be noted (par. 102) that they have, for the present at least, departed from the principle which guided them in fixing a standard for sewage pollutions—the effect of the discharges upon the streams—and take as their guide the amount of purification which has been found practicable by experience. They recognise that it is important (par. 113) that the standards for different trade wastes should be uniform as far as may be, but at the same time they suggest standards which vary somewhat even for liquids of similar character.

The report goes on to suggest alterations in the existing law, mainly in connection with the establishment of a central authority, and concludes by acknowledging the incompleteness of the information they have been able to acquire and the necessity for further investigation.

Dealing with these subjects in the same order, it will be recognised that the opinion expressed in the Third Report as to the advisability of trade refuse being generally treated by sanitary authorities along with their domestic sewage is perfectly sound. It is more expensive and not so effective for each manufacturer to deal with his own refuse, and, moreover, the multiplication of purification works is objectionable, both because of the risk of nuisance in crowded localities and because of the increased opportunity for neglect and mismanagement. It seems also quite fair that, for the facilities afforded them, the manufacturers should contribute to the expense of treating their refuse, as the commission now suggest. Legislation on these lines has already been passed in the Ossett Corporation Act, 1914.

There is little need to discuss the recommendation that a central authority dealing with all subjects relating to the pollution of rivers should be set up, as opinion is unanimous on that point. It is greatly to be regretted, however, that the labours of the commission have been brought to an end before the establishment of such an authority, so that the skilled observers of the commission, who have for so many years done such excellent work, could continue their labours without interruption.

It seems to be suggested that all work of investigation and experiment should be done by the central authority, leaving the Rivers Boards only the duty of watching for infringements of the law. This would certainly be a mistake, for the Rivers Boards will be much more intimately associated with the manufacturers, and their officers in much closer touch with the various problems that present themselves. Some means should be devised for making use of the services of the Rivers Boards in this work of investigation and experiment.

The officers of the central authority would be ex-

exceedingly useful in testing the results of methods of purification existing or proposed, but they are not at all likely to be very successful in devising new methods, and no practical man would suggest that they would be very useful in devising new trade processes. In this connection it may be pointed out that it is difficult to agree with the view of the commission (par. 14) that it is unlikely that manufacturers will discover for themselves the best means of rendering their trade liquids innocuous. As a matter of fact, nearly all the existing methods of purification, or new trade processes which avoid the discharge of liquid refuse, have been devised by the manufacturers themselves or by the chemists and engineers employed in connection with their business; these are indeed the persons most likely to be successful.

As to the question whether the recommendation that legal standards for trade refuse should be set up is of the greatest importance, by considering these they have divided the different kinds of waste liquids under two heads

(*a*) Those for which efficient purification is practicable, and

(*b*) Those for which efficient purification is not in the present state of knowledge practicable,

and the grounds for this division do not appear. For instance, among the liquids in class (*a*) they place the refuse from wool scouring, tanning, and brewing, liquids which are most difficult to purify, whereas in class (*b*) they include dye-waters and other refuse from the textile trades, with regard to the effective purification of which they had much evidence in detail before them. One can only conclude that they have not had time to consider this evidence, and that in the circumstances the opinion of the commission of 1868 is the sounder one.

The general question of the advisability of fixing legal standards for sewage effluents has been discussed in the report upon the Eighth Report of the Royal Commission, presented to the board in February, 1913, and all the reasons there given against the adoption of such a recommendation, and all the difficulties which surround the question apply with still greater force in attempting to fix standards for trade effluents. It was pointed out that all the officers of rivers authorities and of county councils interested in rivers pollution had stated that they did not think it was practicable to fix a legal standard for sewage effluents. Since then the experts advising the Association of Municipal Corporations have reported that they believe the setting up of a standard of purification for sewage effluents to be quite impracticable, and the inconsistencies which appear in the recommendations of the commission with regard to trade effluents go far to prove the still greater impracticability of fixing standards for these.

For the present at least (par. 102) the commission have departed from the principle upon which they formulated standards for sewage effluents, not recommending for trade effluents that the standards should depend mainly upon the volume of the streams into which the effluents are discharged, but that each trade should have its own special standard (pars. 110, 111, 128).

In suggesting standards they pay no heed for the present to the effect of the effluents upon streams, and it is certain that many effluents complying with their requirements will be most deleterious, often destroying the higher forms of life in a stream and producing profuse fungoid growths, or where effluents are strongly acid or alkaline, rendering the stream water useless for manufacturers lower down.

On the other hand, it will be admitted that a fixed standard will bear very hardly upon some manufacturers, as it is obvious that purification works capable of producing the necessary result may be easy and cheap to construct in one situation, and yet exceedingly expensive in another. The commission afterwards, in discussing alterations of the existing law, seem to recognise this, and would leave every manufacturer free to appeal to the Court that he should not be obliged to conform with the standard fixed for his trade, but this obviously means that the suggested standard is only to be a general guide and not fixed and unalterable.

In examining the standards suggested it is first to be noted that no standard methods of analysis are fixed, although this is all-important in dealing with trade liquids. In the appendix (p. 154) Dr. McGowan suggests certain methods, but states also that further work on the subject is necessary. The figures given by him are sufficient evidence of the necessity for fixed methods.

It is not easy to discover the principles which have guided the commission in their choice of figures. In regard, for example, to distillery refuse, brewery refuse, and the discharges from wool-washing—liquids with which the commission have themselves experimented—the standards suggested are comparatively stringent, although these liquids are among the most difficult to purify. Moreover, the standard suggested for brewery refuse is more lenient than that for distillery refuse, although the difficulty of purifying the latter is considerably greater. The same inconsistency is noticeable in other cases.

In examining the evidence upon which the standards for various trades are based, it is evident that the commission had before them many instances of purification works producing effluents of a much greater degree of purity than the standard suggested. For example (p. 41), they had evidence that 156 samples of print works effluent gave an average of 5·3 parts of suspended matter per 100,000, and that 32 of these samples contained practically no suspended solids, and yet they suggest a standard of 6 parts of suspended matter per 100,000. The standard for suspended matter in bleach waste has apparently (p. 51) been fixed on the same system. On the other hand, because of evidence of good results in certain cases where dye waters in the woollen trade are treated, they have fixed the standard of suspended matters at 4 parts per 100,000, and a similar standard has been fixed for the effluent from wood-pulp paper mills, based on somewhat similar figures. Again, it is to be noted that for effluents from distilling, brewing and wool-scouring, on which the commission themselves carried out experiments, they have recommended the more stringent standard of 3 or 4 parts of suspended matter per 100,000, and one is led to the conclusion that if the commission themselves had experimented with the other classes of refuse they would have found themselves able to recommend the more stringent standard. They had, however, plenty of evidence before them, as appears from their report, that these other liquids can be purified so as to comply with this higher standard, and it is difficult to see what further evidence they would suggest should be brought to persuade the central authority to make these suggested standards more stringent.

By fixing a standard more lenient than is attained in the better-managed purification works, the commission are favouring that carelessness in management which is one of the greatest difficulties to be met with. There are indeed many existing works producing effluents possibly complying with the more lenient standards suggested, which could do much better work with a little more attention on the part of the manufacturer.

The commission of 1868 were at least consistent. They suggested one standard for all liquids, whether effluents from sewage works or from trade processes. This commission have adopted different standards for sewage and for trade refuse, and these vary for sewage in different circumstances and for different classes of trade refuse, while the principles upon which the suggested standards for the two kinds of effluent are based also vary. It is not logical to fix a standard for trade refuse allowing more suspended matters and a much greater amount of organic matter than that which governs the discharge of sewage effluents, perhaps into the same stream, and almost at the same point, and, it may be, in less volume.

No recommendation is made for dealing with the manufacturer who adopts the easy method of complying with their suggested standard by dilution of his effluent. If a manufacturer has a plentiful supply of clean water he can easily, by simple dilution, make his refuse, however foul, comply with the suggested standard, and if the clean water would otherwise reach the river it is obvious that the manufacturer has done nothing to lessen the burden of pollution of the stream.

One great objection to the fixing of standards, which must always be based on existing knowledge, is the resulting discouragement of the discovery of new methods of purification or new trade processes by which polluting discharges may be avoided. It is in this latter direction that the greatest progress is to be looked for. For example, in the case of coal-washing refuse, there seems to have been no suggestion of re-use of the effluents at the time of the commissions of 1865 and 1868, whereas now the re-use is almost universal, and in many cases there need be no effluent discharged; in ammonia recovery from gas—a process which has given rise to most polluting and intractable liquid refuse—the difficulty of dealing

with the refuse has led to the introduction of processes in which little liquid refuse is produced, and that of such a nature that it can be used up on the premises, so that there is no necessity for its discharge. In cleansing wool, processes have been devised which do not necessitate the discharge of any intractable liquid refuse. In the case, too, of other kinds of trade refuse, means of purification have been devised—so effective that the manufacturer can re-use his effluent instead of discharging it to a stream. And all such discoveries as these seem to be ignored in fixing legal standards based on existing methods of purification.

The suggestions for the alteration of existing law need careful consideration. The commission divide cases to be dealt with into two categories—where a general standard has been prescribed, and where there is none.

Where a general standard has been prescribed the Rivers Board,

" before taking proceedings, shall serve a notice on the manufacturer specifying the requirements of the general standard and the period within which the requirements are to be complied with. After the expiration of that period proceedings may be taken against him for non-compliance with the notice (but on no other ground—*i.e.*, not on the ground that he is discharging a ' poisonous, noxious or polluting liquid,' but only on the ground that his effluent infringes the particular standard), and the consent of the central authority shall not be required to such proceedings. The proceedings should not be taken in a county court for an order, but in a court of summary jurisdiction for a penalty. The court may extend the period in which the requirements are to be complied with, and if they consider that it is doubtful whether the notice can reasonably be complied with, they shall remit the question to the central authority, who shall confirm or modify or cancel the requirements, and who may fix a period during which the requirements as confirmed or modified shall be in force or shall be cancelled, as the case may be. The central authority may from time to time extend such period, but on the expiration of the period the requirements of the general standard shall be deemed to be again in force in regard to the works in question."

This appears to mean that the court is not obliged to impose a penalty even should they decide against the defendant; also that the court may revise the requirements of the central authority and say whether the general standard is reasonable in the particular case. If they decide that it is unreasonable, they have to remit the question to the central authority, who shall confirm or modify or cancel the general standard they had themselves set up, and who may fix a period during which no proceedings can be taken by the Rivers Board. After this the Rivers Board may again apply to the court for a penalty, and may not obtain it.

To confine the proceedings to a court of summary jurisdiction will renew the difficulties which the board has experienced in taking proceedings under their Act of 1894 before a bench of magistrates, several of whom may themselves be offenders against the Rivers Pollution Prevention Acts, and who are therefore not likely to favour the imposition of penalties, and who are extremely likely to hold the view that any standard suggested is much too severe.

The commission definitely suggest that no manufacturer is to be proceeded against for polluting a stream, but only on the ground that his effluent infringes the particular standard.

Where no general standard has been prescribed, the Rivers Board,

" before taking proceedings, shall serve a notice on the manufacturer specifying the degree of purification which they propose to require, certifying that means are available for meeting their requirements, and prescribing the period within which their requirements are to be met. Within one month of the service of the notice the manufacturer may appeal to the central authority against the notice. If he does not appeal proceedings may be taken against him after the expiration of the prescribed period as if the requirements of the notice were a general standard in force in regard to his works. If he appeals the central authority shall confirm or modify or cancel the requirements of the sanitary authority. If the central authority confirm or modify the requirements, such requirements, as confirmed or modified, shall be deemed to be the standard in force in regard to the works of that manufacturer for such period as the central authority shall specify. The central authority may also extend the period within which the requirements must be complied with, and on the expiration of such period as prescribed or extended proceedings may be taken without the consent of the central authority for the recovery of a penalty for non-compliance with the standard in force. If the central authority cancel the requirements for a period no proceedings shall be taken within that period."

It would apparently be quite possible in such a case for the Rivers Board to fix a provisional standard, for the manufacturer to appeal to the central authority for this standard to be modified, for the Rivers Board to apply to the court for a penalty, for the manufacturer to represent to the court that the standard was too stringent, for the court to refer the matter again to the central authority, for the central authority to confirm or alter their previous decision, and fix a period within which no proceedings may be taken by the board, after which the board would again have to apply to the court, who might or might not impose a penalty.

It is difficult to see that this mode of legal action is any better than that under the existing law, or what is to be the advantage of fixing legal standards if there may be an appeal against them in every case. The procedure of the Rivers Board would certainly not be any more direct or less cumbrous than at present. Each case might have to be argued in full both before the central authority and the court, and finally the court might impose no substantial penalty; so that it would pay the manufacturer to employ every legal device for delay, and thus to postpone the expense of constructing purification works.

The suggested alteration of the law seems expressly to nullify the recommendation that there should be prescribed standards, since it is suggested that they can be altered in any individual case on appeal either by the Rivers Board or the manufacturer. The alteration of law would not in practice differ much from that suggested in the 1913 report—that a Rivers Board should be able to call upon a polluter to use the best practicable and reasonably available means to purify his refuse, and if any dispute upon this point arises it should be referred to the proposed central authority, " whose opinion should be decisive, and whose certificate should be accepted as conclusive evidence and a bar to all proceedings under Rivers Pollution Prevention Acts. If the circumstances of the case were to alter, or if better methods of purification were discovered, the case might again be referred to the central authority for their decision." But it seems uncalled for to submit the requirements of the central authority, settled presumably after a local inquiry, to a magistrate's court, unskilled in such matters and possibly biassed.

Standards published from time to time by the central authority would be useful, not as showing legal requirements, but as guides to show what they might consider reasonably good effluents under ordinary circumstances, and would then have much the same value as the standards of comparison at present in use by the Rivers Board and other similar authorities.

It may be argued that there is little difference between the proposals of the commission and those suggested in the report to the board of 1913, inasmuch as there is the possibility of appeal either for the manufacturer or for the board in any case. But this is rather evidence that the suggestions of the commission that legal standards should be prescribed have failed, and, what the proposals of the commission really amount to is that the Rivers Board or the central authority should declare what quality of effluent in any individual case could be considered satisfactory, and that the central authority should finally decide whether the manufacturer is doing everything practicable to produce such an effluent. The machinery suggested by the commission for reaching this end seems to be somewhat cumbrous, and would leave many opportunities for delay on the part of the manufacturer.

With regard to proceedings by riparian owners against manufacturers, the commission have made no recommendation. In their Fifth Report (par. 318) they recommended that no action should be allowed to be brought in respect of damage alleged to be due to the discharge of a sewage effluent which complies with the standard fixed. They recognise (par. 106) that there is a distinction between the case of a sanitary authority dealing with sewage in the execution of a public duty, and a manufacturer discharging refuse from a profitable trade process.

The proposals of the commission that the Rivers Board should be notified at least a month beforehand of the proposed discharge of trade refuse from any new source, that the Rivers Board should have statutory authority for inspecting works and rivers, and facilities for taking samples, and that the power should be given to demand purification of waters proceeding from mines, would be welcome additions to the powers of the board.

The report closes by confessing that the commission have been quite unable to complete the investigations which they would desire. In various parts of the report the commission acknowledge the incompleteness of their labours, and it is to be regretted that they have committed themselves to recommendations so important without having been able to study the various questions more closely.

THE DISPOSAL OF LIQUID AND SOLID DOMESTIC REFUSE IN RURAL AREAS.

This subject is not dealt with in any great detail, nor is there anything very striking in the recommendations of the commission. They point out that where the population is at all dense, and where there is an abundant water supply, sewerage and a water carriage system are almost necessarily involved. Their remarks will be taken in many cases as rather too favourable to the provision of cesspools, which can only be looked upon as evils even when unavoidable. They appear to suggest that in villages of scattered houses excreta and slop water should be disposed of upon the gardens, somewhat after the well-known method advocated by Dr. V. Poore; but all sanitary officers who have had rural districts under their charge know how difficult it is to ensure the absence of nuisance when such methods are resorted to. In theory the plan is excellent; in practice it may lead to intense local nuisance, although it has the advantage that it prevents river pollution which might otherwise be caused.

ASPHALT ROAD CARPETING AT ALDERSHOT.

A party of engineers and surveyors were the guests of Clarmac Roads, Limited, at Aldershot recently, and were afforded the opportunity of witnessing the process of laying that firm's Clarphalte asphaltic road carpeting. Seats had been reserved on the 11.45 a.m. train from Waterloo, and on arrival at Aldershot the party were conveyed by motor cars to the Royal Hotel, where luncheon was served. The chairman of the company, Mr. Allbach, presided, and in the course of an interesting speech made reference to the association of the firm with Claridge's Patent Asphalt Company, Limited—which had, he observed, been established over three-quarters of a century—and to

the fact that they were also concerned in the manufacture of tar-macadam under the name of Clarmac—which is made from hard cold-blast slag, with a tar-compound as a matrix.

The party afterwards proceeded, under the guidance of Mr. F. C. Uren, the engineer and surveyor to the Aldershot Urban District Council, to Boxall-lane, where the work of laying Clarphalte, 1 in. thick, on the existing water-bound macadam was in progress.

The composition of the material was fully described and criticism was invited, but the general opinion was that the method of manufacture and laying was very satisfactory. After inspecting roads of other descriptions, visits were paid to the German internment camp at Frimley, and on the return to Aldershot tea was served at the Royal Hotel.

EXAMINATION QUESTIONS IN ROAD CONSTRUCTION.

[The following suggestions and "model" questions have been sent to us by a valued contributor, who asserts that he has been studying Mr. Boulnois' "Glossary of Road Terms," and that when he got to the word "crazy" he became "incrassated."]

INSTRUCTIONS TO CANDIDATES.

In answering the questions, tar [as specified by the Road Board], and not ink, is to be used.

All paper must have a sharp "arris," and asphalte must be spelt without the final "e."

Bench marks for identification must be placed on the top right-hand corner of each paper.

No "bituminous" or "coal" will be allowed, and "boning" will disqualify.

Candidates must have a "cross-grip" of all the subjects, and are not to show any "depression," "fretting," or too much "diffusion."

The answers must on no account be allowed to "imbricate," but must, if possible, "incrassate."

"Obsolescence" will be discouraged, and marks will be deducted for "random" work or "packing."

The aim of each candidate should be "resilience."

All candidates will be "segregated" during the examination.

The examiners reserve all "caloric" to themselves, and the right to macadam fuss if necessary.

A "penetrometer" will be used to discover the real value of the answers, and not the "percussion test," as the examiners are not in possession of a small "monkey."

MODEL QUESTIONS.

(1) (*a*) Why do you put a "carpet" on a road "bed"?

(*b*) Has a "seal-coat" anything to do with a seal-skin, especially when "patched"?

(*c*) Must the bed be a "cushion bed"?

(2) What makes the best "dish" of the following articles—"Stone grapes," "Chips," "Herring-bone," or a "Sub-crust"; are they "meaty," and which of them is the best "filler"?

(3) Has the "breeze" on the surface of a road anything to do with the "waves"?

(4) Where did they "Pitch Mac"? Why did the "Rag bolt," and where? What made the "Rock drill"? What made the "Sand blast"? and did it "Blast Furnace Slag"?

(5) What is the "affinity" between Poly Cycle and Anne Thracine, or is there no "bond"?

(6) Why is it necessary to give a road a "stocking," and has this anything to do with the "toe" of an embankment? Does the word "topping" apply in this case?

(7) Does the expression "corduroy" apply to the "carpet" or the surveyor's breeks?

(8) What did the hammer say when it saw the "stone dressing"? [Note.—The following obvious answers are disallowed: (1) "Axe" me. (2) You *are* a "free stone."]

(9) When is a "hanging road" on its "haunches," and should it be "scarified," or would "racking" meet the case?

(10) What is the difference between sentiment, "centimetre," and "sediment"? and is the "Dandy" always "siding"?

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Given under my "way-leave" this 25th day of August, 1915, at Colney Hatch.

"KECK PARBUCKLE."

Rural Council's Complaint.—The attention of the Droxford Rural District Council was recently called to the fact that a number of the roadmen who were discharged in order that they might be employed in agricultural work had since been employed by the county council. Several councillors complained of the action of the county council. It was argued that if the county council desired to take their men they should have mentioned it first, because, after all, although they were different bodies, they were doing the same work in respect of the roads. It was therefore wrong that they should enter into competition at a time like the present. The council decided to ask the Local Government Board to investigate the matter.

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Institution of Municipal and County Engineers.

EASTERN SUB-DISTRICT MEETING AT CROMER.

Gratifying success attended the meeting of the Eastern Sub-district (Suffolk, Norfolk and Cambridge) held on Saturday last at Cromer, and the useful discussions which took place in the course of the proceedings should be a distinct encouragement to other districts of the institution to consider the practicability of arranging similar gatherings of the members within their areas. Meetings of this character, carried through with the necessary thoroughness, as was that of Saturday, would seem to be one of the most effective means yet devised for assisting the development of the institution.

Those present at Cromer included Messrs. H. Blewitt (Oulton Broad), R. Croome (Cromer), H. Collins (Colchester), E. H. Essex (Leyton), J. H.

Mr. R. Croome.

Surveyor to the Cromer Urban District Council.

[Mr. Croome is a son of the late Mr. Evelyn Robert Hayle Croome, land agent and surveyor, of Tewkesbury. He was articled to Mr. G. P. Milnes, Assoc.M.Inst.C.E., architect and surveyor of Stroud, engineer and surveyor to the Stroud Urban District Council, and architect to the Stroud Joint Hospital Board. In 1899 he was appointed in charge of the Cromer office of Mr. A. F. Scott, F.S.I., architect and surveyor of Norwich, surveyor to the Cromer Urban District Council, and engineer to the Erpingham Rural District Council. In 1907 he became surveyor to the Cromer Urban District Council, since when he has carried out the following works: Isolation hospital (£4,500), public conveniences (£2,200), septic tanks and extensions of sewer outfall (£3,727), storeyard (£2,500), fire station (£1,150), cemetery (£1,500), destructor (£1,500), public offices, mortuary, and stables; also a large amount of sewerage, road improvements and construction, and the usual work required in a progressive and rising seaside resort, including private street works to the value of £12,000. Other matters in which he has been engaged include the laying out of several building estates in Cromer and the district, and sewerage, sea defence, and road works in several parishes within the Erpingham Rural District.]

French (Harwich), J. E. Hattersley (Saxmundham), G. W. Lingwood (Stowmarket), J. R. Mead (Ipswich), F. W. Smart (Bedford), F. Hall Smith (Sheringham) and R. E. Wilson (Leiston).

In welcoming the members the Chairman of the Urban District Council (Mr. D. Davison) said his only regret was that they had come to the town at a time when conditions were far from being normal. Such gatherings were, however, very useful, for they must all realise that public services must go on very much the same as usual, and by meeting together and exchanging views they could be mutually helpful one to the other. Speaking as one who had had some experience in public departments, one of the things in modern administration which had struck him was the development in trained and educated service which had taken the place of uneducated and rule-of-thumb methods. That was of great importance from the point of view of the public health of the community, and particularly so at a time when they were obliged to put forth their greatest efforts to maintain public efficiency at an adequate standard in face of the severe economies which they were called upon to practise. He thought they would find in Cromer some matters of great interest. They had an especially good health service, and they would see that the aim of successive councils had been to create and maintain a high level of public health conditions. The cost had been heavy to such a small community, but he thought it would be difficult to find another town which would surpass them in cleanliness, method and good order.

Mr. Harold Collins, in proposing a vote of thanks to Mr. Davison, said he had not the slightest doubt that meetings, even in a comparatively small place like Cromer, were exceedingly valuable. Members who never went outside their own towns were apt to get into a groove. There was always something to learn elsewhere.

The vote of thanks was carried.

In the absence of the president and chairman of the district (Mr. H. T. Wakelam), who is away on the Continent, Mr. Collins was voted to the chair.

The minutes of the previous meeting having been read and confirmed, it was announced that apologies for non-attendance had been received from Messrs. W. S. Powell (Norwich), C. Harrison (East Stow), J. Dunn (Chesterton), H. Wood (Norwich), R. S. W. Perkins (Ely County), F. L. Burch (East Dereham), J. W. Cockrill (Great Yarmouth), W. Starkie (Wilton), J. Julian (Cambridge), A. E. Collins (Norwich) and C. L. Hamby (Beccles).

The question of

HOW TO PUT MORE LIFE INTO THE EASTERN DISTRICT.

was afterwards introduced by Mr. R. Croome, the surveyor to the Cromer Urban District Council.

Mr. Croome said he was afraid he held rather strong views on the apathy and lack of interest of members generally in the institution. Had they ever really thought what the institution might be to surveyors, and of what little practical use it was?

Was not the institution like a wheelbarrow—capable of doing much good work, but requiring pushing to do it?

He knew only too well the general dissatisfaction among many of the rank and file with whom he had come into contact. He only here referred to it as probably the chief reason for the lack of life in that district.

Several years ago Bedfordshire, Hertfordshire, Northamptonshire, Essex, Huntingdon, Berkshire, Cambridgeshire, Suffolk, Norfolk, and part of Middlesex were lumped together to form an Eastern District. What was the result? Why, what anyone with a little foresight should have anticipated—practically an East Metropolitan District. In 1912-13 there were six meetings—four in London and two just outside. In 1913-14 there were meetings in London, Hounslow, Chelmsford, and Ipswich; and in 1914-15 at London, Southend, Bedford, Tilbury, and Norwich.

Now, it was obvious that Norfolk and Suffolk surveyors were not wildly enthusiastic about a system which meant spending the best part of two days and £2 in order to visit London to listen to Metropolitan surveyors discussing the problem of how to make a good road at 15s. per super. yard, when most of them thought themselves very fortunate if they were allowed 15d. to do it. On the other hand, Metropolitan surveyors were not interested in their troubles.

He had a strong objection to multiplying associations having practically the same object, and had often asked himself why certain counties and districts felt the need of a Surveyors' Association—Somerset, for instance—when their own institution should be all-sufficient. He thought the answer was that most of them felt the need of something more practical, even if a trifle less heroic than such a paper, for instance, as was given at Yarmouth about "Cities Beautiful by the Sea," in which the writer advocated, among other things, that main streets should at least be lighted to "newspaper" standard. Even supposing that standard was possible, he could not see anything particularly beautiful about it. It was certain the surveyor who seriously suggested it to his council would be considered a bright beauty. Besides, was it altogether advisable to encourage people to walk about the streets reading newspapers? That scheme was more suitable for a medical congress than a meeting of surveyors.

Now, the strength of a society largely consisted in the unity of action which characterised its proceedings, and this could only be arrived at by encouraging in every possible way the closest association

among the members. How was this to be encouraged? Why, by local meetings on the lines of the county associations he had referred to. The advantages of these meetings would be many—(1) It would encourage the institution to "wag its tail," as it were. He did not believe in the tail wagging the dog, but he did believe a healthy dog should wag its tail. The rank and file should be considered a little more than they were. (2) They should get to know their neighbours; for instance, he knew many surveyors, but only three Norfolk members. It might be fortunate for them not to know him, but he was sure it was unfortunate for him not to know them. (3) They could talk over their own little problems. He used the word little in comparison with the problem of lighting streets to "newspaper standard." For instance, Cromer suddenly decides to grapple with an epidemic of what are called "temporary buildings," for want of a better name. What procedure had been found best in adjoining districts? Sheringham has, say, found Rocmac most successful for roads. Mr. Hall Smith's experience would be of far more practical use to them than an elaborate paper on the same material used in some large centre under totally different conditions. (4) They could visit works of interest. Probably quite near at hand instructive works were in progress, and it only needed someone to bring to those who would be only too pleased to show those who would be only too glad to see. (5) They could occasionally ask a member—not necessarily in the district—to speak to them on a particular subject upon which he was an acknowledged authority, and in which they were particularly interested—say tar-macadam.

Other advantages had suggested themselves to him, as doubtless they had to those present, but these were sufficient to go on with.

Now, how was this millennium to be reached? Mr. Webb, formerly secretary of the Eastern District, and Mr. Mead, of Ipswich, were, he believed, the prime movers in a step in the right direction by dividing the Eastern District into sub-districts, and he was sufficiently optimistic to think one more step in the right direction could be taken by sub-dividing the sub-district, each county forming a branch.

If this was found successful in that district it might be extended to others, with the result that each district would be composed of a certain number of branches.

A branch would be worked as follows: A chairman and secretary would be appointed annually, the chairman to hold office for one year only. At least three meetings would be held annually, one of these meetings to be a joint one of the sub-district, to be held in each county in turn. The place of branch meetings would be decided by the majority of members at the previous meetings. Opportunity should be taken to visit any interesting works in progress, and such visit might be combined with one of the ordinary meetings of the branch. As occasion suggested, some member who was an acknowledged authority on some particular subject of special interest to members should be asked to address a meeting. Only members of the branch would be invited to attend branch meetings.

The sub-district would be worked as follows: The chairman and secretary of each branch would form the committee for the sub-division. A chairman and secretary would be appointed, the chairman to hold office for one year only and be a member of each branch in turn. One meeting at least would be held annually. At this meeting one member would be elected as the representative of the sub-district on the council, and two members on the committee of the Eastern District.

That, briefly, was his scheme. The advantages he claimed for it were as follows:—

Frequent and regular meetings, at a convenient centre, at little expense to members attending—bringing the institution to their door.

These meetings would enable them to get into touch with their neighbours for (1) social intercourse, (2) exchange of ideas, (3) discussion of local matters of interest—such as the carrying out of a new Act, or some experimental road work.

He might as well at once admit that the sub-district hardly seemed ripe for immediate division into county branches; for instance, Norfolk at present had fourteen members, Suffolk twenty-two, and Cambridge nine. There were still several surveyors in each county fully qualified to become members; these should be "roped in," and probably would be if they showed a little more life.

He would for the present draw a line from Ely to Southwold, and have a branch for members north of that line, and another for those to the south of it. That would give the north branch a start with twenty members, and the south twenty-five.

The proposal for the sub-district to have direct representation on the council, and on the committee of the Eastern District, was an important one, in his opinion. At present they had practically no voice in their selection. The meeting for their election was held in London, and he for one did not care to spend £2 to attend, especially as one might rest assured that the final vote rested with the majority, who were East Metropolitan members.

It was useless to say we were to have a certain number of meetings in the year; they must be held. That was one reason why he proposed to have a chairman for each branch, and for the sub-district; also it was why he proposed to change every year that chairman. It should give that amount of energy required to get the meetings held, as each chairman would be sure that during his year of office it should come up to the standard of his predecessor. They would also have help from ex-chairmen, who would remember the difficulties of the office, and thus appreciate and support the existing holder. And help would be forthcoming from those who hoped one day to be chairman—a combination of energy they never got when the chairmanship was a "freehold."

Mr. E. H. Essex (Leyton), in proposing a vote of thanks to Mr. Croome, said he thought the latter's suggestions would be most useful to them in their little "inner circle." They were really very good, and should meet with their unqualified support. The question before the meeting was one that appealed to all of them, and one way to do what was proposed was to make the institution more of a scientific institution than it was at present. His view was that the institution could be made much more helpful to surveyors than it was if only the members would attend in larger numbers and criticise the various papers that were brought before them. Mr. Croome's idea was that the institution was a little bit too unwieldy, and wanted to be split up into smaller divisions. That was all right as far as it went, but unless they made the institution more scientific it was not doing all the good it might. By "scientific" he meant the careful collection of all the facts relative to a given subject and a regular tabulated statement of the whole. Theory was the exposition of science, and until they had got the science of a subject it was impossible to expound the theory; and if they had not got the theory, they were not likely to be very practical men. Readers of papers often came forward and gave them their view of things, but they did not give them the facts upon which their views were based. Their principal object, he assumed, was to give each other the facts regarding their own particular work, and if they had those carefully tabulated they could compare one with the other; and if each member would support the secretary in a practical way by sending up tabulated particulars of their own work with full details, they might have scientific facts and accurate figures to go upon.

Mr. J. R. Mead (Ipswich) remarked that that particular district seemed to have been rather badly served with meetings of any description during the past few years. What was required was to bring the members of the three counties together so that they could become acquainted with one another. As things stood at present a member generally did not know more than six other surveyors in his own district. His idea was that by holding those small district meetings, and giving the members an opportunity of reading and discussing papers, they would be more likely to get them to speak and give others the benefit of their experiences than they would at larger gatherings. He endorsed what Mr. Essex had said as to the value and importance of tabulating statistics and facts, though he was afraid it was just a little over their heads at present, having regard to the fact that the members did not know one another.

Mr. F. Hall Smith (Sheringham), seconding the vote of thanks, observed that they were "left in the cold" in that corner of Norfolk.

Mr. G. W. Lingwood (Stowmarket) agreed that it would be an advantage to the institution if they could bring members together in the manner suggested. He agreed with what Mr. Essex had said as to the importance of collecting and tabulating statistics which should embrace all details of the work described, without which it was impossible to form a correct estimate of what one was doing in comparison

with another town. He thought they might get more members from Suffolk; many surveyors in the county were not members.

Mr. F. W. Smart (Bedford) said that, although he was the hon. secretary of the Bedfordshire Sub-district, he had not yet received any papers, minute books or instructions, but when he did he would be pleased to do all he could for the surveyors in the district. Many of the suggestions put forward by Mr. Croome could be taken up, but it was useless unless every individual member intended to take up the question. Mr. Essex had said that statistics were valueless unless they were comparative. If they could only get a standard on which to keep all these statistics it would enable them to make a proper comparison between districts of a similar character. He hoped it would be taken up strongly, for that was the only way in which they could get that local information that was so useful.

Mr. J. E. Hattersley remarked that these sub-district meetings would enable them to discuss particular points with more freedom and on more friendly lines than was possible at the larger gatherings. If the meetings were taken up in that attitude they would prove most beneficial.

The vote of thanks was passed and Mr. Croome replied briefly. He wished to make it clear that what he had said was not in criticism of anyone, his sole idea being to "buck up" the institution. The meeting that day was due to Mr. Mead's energies, and if it was the means of doing something in the direction he (the speaker) had suggested, they had to thank Mr. Mead.

(To be concluded.)

ANNUAL GENERAL MEETING IN LONDON (*Conclusion.*)

Among the papers submitted at the recent annual meeting of the Institution of Municipal and County Engineers was one by Mr. W. A. Farnham, assoc.m. inst.c.e.i., f.s.i., engineer and surveyor to the Foots Cray, Kent, Urban District Council, the subject of the contribution being

FIRE BRIGADE ORGANISATION AND EQUIPMENT.

The paper is reproduced on another page of this issue.

Mr. F. R. Phipps (Basingstoke), referring to Mr. Farnham's contention that a pump with an output of 220 gallons per minute was ample, said that figure was of no use without the pressure on which the capacity was taken. He had lately carried out some tests with a new petrol motor, and obtained 260 gallons per minute at 140 lb. pressure. With 120 lb. pressure he obtained 275 gallons a minute, and with 100 lb. pressure 300 gallons a minute. So it was evident that the lower the pressure at the outlet the greater the amount of water that could be obtained. He maintained that it should be supplied at 140 lb. pressure, because in a town of heavy gradients, and perhaps a long length of hose, it was necessary that they should have high pressure.

Mr. G. W. Lacey (Oswestry) said this paper was evidently written by a man who had had considerable experience in fire brigade work, and as many surveyors on taking up their appointments found it part of their duty to take charge of the brigade, this was in many respects a very valuable paper. This work to the majority of their members was an absolutely new thing, and it therefore occurred to him that if Mr. Farnham had included in his paper suggestions not only with regard to the equipment of the fire brigade, but some information as to the making of drills interesting to the members of the brigade, it would be serviceable. There were several suggestions which Mr. Farnham made on which he did not see eye to eye with him. He suggested that the county council should be the rating authority; many of them did not desire that the county council should have too much power of interference. There were many borough councils and urban districts which controlled their own fire brigades and served a large district round their town. There were, of course, places where the work was almost entirely voluntary, and many did not have any fire protection service at all, though, of course, they were protected by urban places near. Mr. Farnham stated that insurance companies should not bear any portion of the cost of fire protection. He did not hold that view at all. The comparison made between fire and life insurance he did not think would bear examination. A life insurance company insured a man's life, and he died only once; but a fire might happen many times. Thus a fire brigade service was a protection to the funds of the fire insurance company, which, he considered, should be more free in their contributions for the services rendered. In many towns the fire insurance companies had brigades of their own, which showed that they regarded fire protection as a good thing for themselves.

Mr. Gamble (London Fire Brigade) said, as a very old member, but now, alas! only a visitor, he hoped they would allow him to make a few remarks upon Mr. Farnham's paper. First, let him say he held the unique position of having filled in his time most of the offices outlined in the paper. The general scheme was good, and undoubtedly the municipal engineer by his training and knowledge of local affairs should have no difficulty in mastering the science of fire extinction. Those engineers who had undertaken the work had proved a great success. He must, however, warn the members that the position of a chief of a fire brigade was not a bed of roses, and in a small town demanded a large amount of attention. Where fires were few it was necessary, in order to keep a brigade efficient, that constant drills be carried out, when the officers must be present. In small districts the municipal staffs were limited, the chief officials having to carry out most of the work personally. It was necessary, of course, that the officials should have the opportunity of obtaining week-ends, particularly as even the annual vacations allowed by the authorities were short, without having to make formal application to the authority. The chief officer of a small brigade would be expected to attend every fire, however small, or be prepared to explain the reason for his absence, and woe betide him should he not have attended if the conflagration were in a small building owned by a member of the authority. He quite agreed with Mr. Farnham that the areas covered should be sufficiently extensive to justify the employment of a considerable force. The utilisation of motors allowed large distances to be covered in the time hitherto taken even to obtain horses. The difficulty in attracting a good class of man exclusively for small brigades was the inadequate remuneration offered. How could a man with a scientific education be expected to give his whole time and live in respectable surroundings upon £3 a week? The only way in which an adequate salary could be justified was by assigning several municipal duties to such officer—say, for instance, fire brigade, inspector of explosives, weights and measures, canal boats, hackney carriages, &c. The foregoing remarks referred to fire extinction; the much larger question of fire protection should, by all means, remain in the hands of the municipal engineer, who should by constant study keep himself abreast of the times and see that the property within his area was properly protected. Some time ago he believed steps were taken to consolidate the law relating to fires and fire brigades, but nothing came of it. There seemed to be an objection in certain quarters to simplifying the law of the land. They must, however, hope that a member of the Cabinet would one day take this matter in hand. The question of Government inspection of fire brigades was not new; much might be done in advising local authorities upon this matter. The great objection, however, to centralisation of this kind was that the ideas of one or two officials were imposed upon authorities and tended to stifle the initiation of improvements, some of the most valuable of which had come from small districts.

Mr. F. Read (Gellygaer) asked what was the relative status of his retained men and of the permanent men. Was it advisable to have a less expensive system of call than the telephone and bell system in a scattered district? In his case he had a district of 26 miles. Would an audible warning be satisfactory with a powerful motor engine?

Mr. H. Gilbert Whyatt (Great Grimsby), describing the arrangements in his town, stated that they had a volunteer fire brigade with only three or four permanent members. The majority of the members of the brigade were on his highway staff, and directly an alarm sounded they dropped their highway work, rushed to the fire station, and got the engine out. The men were called during the night by a separate wire to each house. They found the system comparatively economical, costing about £1,000 a year.

Mr. J. W. Cockrill (Great Yarmouth) referred to a test call which was made at King's Lynn some years ago on the occasion of a meeting of the institution

and it hopelessly broke down.*

Mr. E. Willis (Chiswick) said Mr. Cockrill's remarks showed how necessary it was to test alarms. He made a practice of having them tested every morning. Mr. Farnham said they should be tested from the central station. He mentioned a coded type in connection with the alarms. He had adopted that in connection with schools, but he should like to ask Mr. Farnham whether he had adopted that system in connection with alarms and the firemen's houses. He thought it would be most useful.

Mr. E. R. Capon (Epsom) questioned whether 200 gallons per minute, as suggested by Mr. Farnham, was ample for any fire. It seemed to him a very small quantity.

Mr. Farnham, dealing with Mr. Gamble's remark that the position of chief officer of a fire brigade was not a bed of roses, said he supposed Mr. Gamble had been away from their duties for so long that he thought a surveyor's position was. As for the surveyor not being able to get away sometimes for week-ends, the chief officer of the brigade would also want to get away, and it should be his business to train a good subordinate. He had found the drills a pleasure. Mr. Gamble mentioned a fire brigade officer at £3 a week. If they were to pay him that in some places they would be paying him as much as the surveyor. Those districts would not pay a professional officer; their payment would be nearer 30s. a week. Mr. Gamble suggested that the duties of fire brigade officer should be combined with those of inspector of explosives, weights and measures, canal boats, hackney carriages, and so forth. In many districts they had no inspectors of explosives or weights and measures, no canal boats and no hackney carriages; so he was afraid that would not help them much. Mr. Gamble seemed rather afraid of Government inspection. He thought Government inspection would be of use and free them from the obsolete appliances which existed in many districts. The antiquated manual would not be seen so frequently if they had Government inspection. Mr. Phipps spoke about the pressure of a petrol motor pump. That was a matter for each district, but the pressure might be taken at about 160 lb. There might be places where they had abnormally long lengths of hose, and loss of pressure owing to friction. With reference to Mr. Lacey's question about drills, he might refer him to a useful manual issued by the National Fire Brigades Union, called "The Fireman's Manual," 2s. 6d. As to the county council being the rating authority, he never intended that for urban areas which had their own brigades. He threw it out as a more equitable way of obtaining money from rural districts which paid nothing for fire protection service. His idea was that the county council should collect the money and share it out to those entitled to it. He could not agree that fire insurance companies should pay for this duty; it was a municipal duty. Mr. Read asked as to the status of the retained and permanent men. He had no permanent men; they were paid a fee every quarter, and there was a deduction for any drills which were missed. With reference to calls, there was a great variety of methods. Some places had a hooter. At the present time, under the Defence of the Realm Act, loud signals were prohibited. Mr. Cockrill referred to a defective alarm. That was useless; it was worse than having no alarm. Mr. Willis assumed that he had a metallic circuit; it was an earth return, duplicate wiring. In his case he should say that the motor was leaving the station within a minute or a minute and a-half of a call in the daytime.

Institution of Municipal Engineers.—Mr. R. J. McKenn, hon. secretary of the North-Western District, informs us that it has arranged for a visit to Oldham on September 11th.

Waterproofing of Cement.—The roofs and floors at the Faringdon Police Station have been given a waterproofed cement treatment. We understand that the result of the Pudloed work was very satisfactory.

Save the Blackberries.—In a letter to the *Daily Mail*, Mr. H. L. Evans, of Goring-on-Thames, asks road surveyors and others concerned not to trim hedges "until after the blackberries have ripened," in view of their value as a food in this year of scarcity.

* To the best of our recollection the blackberry was thrown into the air by the [illegible].

HAMPTON-IN-ARDEN SANITATION.

MERIDEN SURVEYOR'S REVELATIONS.

At Hampton-in-Arden recently, a parish meeting was held to consider a report from the Meriden Rural District Council concerning the scavenging of the village and to decide if proposals outlined in a report by Mr. T. H. Negus, the district surveyor, should be carried out.

Mr. Negus, after mentioning that the population of the village was slightly over 1,000 and the number of inhabited houses 270, stated that the existing sanitary arrangements were very similar to those obtaining in other villages where no scavenging scheme was in [illegible], and proceeded:—

"From a careful computation it is estimated that some 200 loads of house refuse and rubbish require removal from the various premises. As usual, it is stored in all sorts of places, sometimes within a few feet of the house, and occasionally at the farthest corner of the garden, which, maybe, abuts on a neighbour's backyard. The tenant is usually responsible for the removal of the refuse, although in a few cases it is a charge on the landlord; but in a large majority of cases it is allowed to accumulate for a year, when a horse and cart may economically be employed. It may be that attention has previously been called to a group of cottages with a range of wet midden ashpits which have not been emptied for about five years, and to another case where some twenty loads of rubbish was accumulated, in which were buried the contents of the pan-closets, and were situate within 20 yds. of the back door. Many of the gardens are not large enough to permit the periodical burial of the contents of the pan-closets, and the cottagers but rarely attach any manurial value to the matter; in fact, the ground soon becomes overcharged and sick, for the area of the garden is generally in an inverse ratio to the size of the family living on the premises. The surveyor has been informed by several of the residents of the increasing difficulty in finding persons willing to scavenge, or a 'tip' for the usual house refuse, which leads to its surreptitious disposal in a neighbour's ditch or on the roadside waste. The present cost may be about 3s. 6d. per house per year, but where a woman is the tenant and has to employ a person weekly in the summer and fortnightly in the winter, a small charge of 3d. a time adds 9s. 9d. to the annual account."

Mr. Negus went on to suggest the use as tips of four old pits on the outskirts of the village, and the employment of a responsible contractor, by whom all middens or wet closets would be emptied four times a year, or pail closets weekly, and house refuse removed monthly.

The surveyor estimated the cost of his scheme at £45 for the first year, though he thought that the figure was more likely to be £55 in these abnormal times; but with the population remaining stationary the second and following years might be expected to show a decreased cost, as water closets replaced pan closets and middens. Finally he emphasised the fact that for public safety it was necessary that the matter should be dealt with at the earliest possible moment.

It would seem, however, that the parish council do not share the fears of Mr. Negus, for, while thanking him for his attendance at the meeting, they decided that the scheme should not be carried out until the existing conditions, due to the war, were ended.

Real Devotion to Duty.—Mr. Thomas Lloyd, surveyor to the Thrapston Rural District Council, in applying for a short leave of absence (the *Northampton Herald* states), said that the council were kind enough to give him a holiday last year, but that he did not take it. He now wanted permission, he said, for two or three days, adding, with love of work in his tones, "I may not go." Then with a true ring of devotion he explained, "I have only been away for one week in nineteen years." Mr. Lloyd's official hours are from 9 a.m. to 5 p.m., with a half-day on Saturday, but he reverses these, and works as a rule from 5 o'clock in the morning until 9 at night. He can walk further now than he could fifteen years ago, having excellent practice in the summer when he gives his horse six months' rest. Mr. Lloyd says he has never had a hobby in his life but his work. He has never had a companion, but spends all his spare hours studying books dealing with his profession.

Work of the Road Board.

FIFTH ANNUAL REPORT.

The fifth annual report of the Road Board, the signatories to which are Sir George Gibb, the chairman, and Mr. W. Rees Jeffreys, the secretary, has been issued as a Blue-book (price 9½d.).

At the outset is given a classified summary of the applications to the board for advances during the year ended March 31st last. Applications were made for £2,001,264, of which £1,541,684, or 77 per cent, was for "improvement of road crusts," and £208,190, or 10·4 per cent, was for "widenings, diversions and improvement of gradients, curves and corners."

The decrease of £592,541 in the amount applied for is regarded as being due to the intimation given to highway authorities after the outbreak of war—that the board were not prepared to continue making grants during the war to the same extent or on the same basis of distribution as in previous years.

districts, especially in urban areas, the distribution of grants on the lines hitherto followed should be suspended. Arrangements were then made with the Local Government Boards of England and Wales, Scotland, and Ireland, that these departments respectively should notify to the board the districts or areas in which, owing to the existence of unemployment, it would be desirable that works of road construction or road improvement should be initiated.

Following upon these arrangements the board communicated with the highway authorities of the areas notified as distress areas and assisted those authorities by indicating advances towards road improvement works amounting in the aggregate to £209,259, of which £205,811 was by way of grant and £3,448 was by way of loan. In addition, however, the board arranged with a large number of highway authori-

Applications to Road Board for Advances in Year ended March 31, 1915.

Purposes of works.	Estimated amount of advances applied for.			
	England and Wales.	Scotland.	Ireland.	United Kingdom.
	£	£	£	£
Improvement of road crusts	1,241,773	199,761	100,150	1,541,684
Widenings, diversions, and improvement of gradients, curves, and corners	198,750	7,948	1,492	208,190
Reconstruction and improvement of bridges	35,333	8,927	44,260	
New roads and bridges	203,374	3,531	225	207,130
Total applications 1914-15	1,679,230	220,167	101,867	2,001,264
Total applications 1913-14	2,127,793	263,747	202,265	2,593,805

Receipts during the year totalled £6,431,792, as compared with £4,810,818 in 1914, and loans amounting to £1,329,043 were advanced against £1,352,603 in the preceding year. The report points out that the difference between £5,909,077, the amount of the grants and outstanding loans indicated and made, and £3,044,769, the total payments thereunder—viz., £2,864,308—represents the sum which is now at the disposal of highway authorities as they proceed with the approved works in progress and in preparation.

A table shows that £1,087,602, or 64 per cent of the total grants made during the year, were for road crust improvements. The percentage is somewhat less than in previous years owing to the fact that the grant, estimated at £400,000, towards the construction of the Brentford loop road from Kew Bridge to Hounslow is included in the figures for 1915.

It has not been possible to classify grants and loans indicated and not yet formally made, but they are mainly for works of road crust improvement. It has been pointed out in previous reports that the experience gained by the board as to the views and requirements of local authorities, and as to the condition and needs of roads throughout the country, has led them to the conclusion that the most pressing and the most universal need is the strengthening and improving of the crusts of existing roads. "The conditions which are being brought about by traffic movements at the present time will," it is added, make that need still more urgent. The great increase of heavy motor traffic on many miles of road in many districts and the difficulties which the highway authorities have found and will continue to find in maintaining their roads in water-bound macadam, point to the conclusion that practically the whole of the funds at the disposal of the board will be required to assist the reconstruction of the heavily trafficked highways of the country, with the result that, unless some additional source of assistance from national funds towards that inevitable work of reconstruction can be found, schemes of new road construction and of road widening on any extensive scale will probably have to be deferred indefinitely."

THE WAR.

As is well known, on the outbreak of war it was decided, after consultation with the Treasury, that, in view of the conditions which it was feared might arise owing to lack of employment for labour in some ties throughout the country the particulars of works of road construction and road improvement estimated in the aggregate to cost £2,115,824, which should be carried out in the event of the state of employment for labour rendering it desirable to do so, and towards which the board promised that they would contribute amounts which were, in most of the cases, settled with the highway authorities concerned. These conditional promises are not included in any of the statements of applications or indications which are given in the report. They have been treated merely as preparations made for contingencies which have not yet happened, and which may not happen. But in the event of distress arising in the future, owing to shortage of employment in any of the areas dealt with, the provisional arrangements already made will obviate any delay in setting in motion a considerable amount of road improvement work.

All the works of road construction and road improvement which have been arranged provisionally are useful works, the need for which has been established, and although the board have not pledged themselves to make grants, unless distress arising from lack of employment should occur, it will be open to any of the highway authorities concerned to make applications for grants to the approved works if and when they desire to proceed with them, and the board will then deal with such applications on their merits, having regard to the amounts which can in the ordinary administration of the Road Improvement Fund properly be granted to the authorities concerned.

AMOUNT AVAILABLE FOR GRANTS AND LOANS.

In their last annual report the board stated that they were making grants on the assumption that they could anticipate their income for a period of at least eighteen months, and that the balance available for grants in addition to indications made up to March 31, 1914, amounted on that assumption to about £2,200,000. The suspension of new grants, to any considerable extent, after the outbreak of war resulted in limiting the amount of the grants indicated during the financial year 1914-15 to £750,929.

It is impossible to state the amount which may be indicated during the current financial year, as that will depend on the policy of the Treasury in regard to expenditure, but the following statement is submitted showing the amount which on the basis of

...ads getting estimated income for eighteen months ...ond was available for grants on March 31, 1915, ...and which remains available to meet any contingencies which may arise, subject to deduction ...ments of a sum of about £300,000 to meet grants ...which are being made in accordance with the terms of the circular letter of March 17, 1915:—

	£
Receipts of the Fund from May, 1910, to March 31, 1915	6,431,792
Estimated receipts from March 31, 1915, to September 30, 1916—say	2,200,000
	8,631,792
Less Administrative expenses to September 30, 1916—say	92,000
	8,539,792
Set aside for works to be carried out in a period of trade depression, the meanwhile used for short loans for road improvement. (Loans to the extent of £1,329,043 have been made and indicated, after deducting loans repaid, but the additional amounts can be provided out of the ... balances of the Fund) ...	1,000,000
	7,539,792
Grants made and indicated up to March 31, 1915	4,580,034
Balance available at March 31, 1915, for grants on assumption that the receipts to September 30, 1916, may be anticipated	2,959,758

ANNUAL EXPENDITURE ON ROADS.

The following table is a continuation for the year 1912-13 on the summarised table printed in the fourth annual report, showing the annual growth of expenditure on roads in England and Wales, Scotland, and Ireland respectively, and also the expenditure per £ of assessable value, and per head of population. It will be noticed that the expenditure on maintenance in Scotland and Ireland cannot be separated from the total expenditure, including improvements, nor can loan charges be separated in the Scottish figures.

Tables showing the expenditure of the various classes of highway authorities are given in appendices to the report.

Year.	England and Wales. Total expenditure on maintenance of roads, excluding loan charges and expenditure out of loans. Administrative counties outside London and county boroughs. Expenditure.	Expenditure per head of population.	Expenditure per £ of assessable value.	Highway authorities in London county and county boroughs. Expenditure.	Expenditure per head of population.	Expenditure per £ of assessable value.	Scotland. Total expenditure on maintenance and improvement of roads and bridges, including loan charges but excluding expenditure out of loans. Expenditure.	Expenditure per head of population.	Expenditure per £ of assessable rental.	Ireland. Total expenditure on maintenance and improvement of roads and bridges, excluding loan charges and expenditure out of loans. Expenditure.	Expenditure per head of population.	Expenditure per £ of rateable value.
	£	Pence.	Pence.	£	Pence.	Pence.	£	Pence.	Pence.	£	Pence.	Pence.
1908-9	6,241,088	74·1	14·2	1,937,929	31·9	4·8	1,178,713	60·0	8·6	962,339	52·7	14·8
1909-10	6,376,262	74·6	14·5	1,982,407	31·1	4·8	1,193,653	60·4	8·7	949,963	52·1	14·5
1910-11	6,778,436	78·6	15·2	2,025,747	31·6	4·8	1,242,765	62·8	9·0	960,199	52·8	14·7
1911-12	7,037,624	81·0	15·5	2,137,348	32·4	5·0	1,305,003	66·1	9·4	1,016,470	55·7	15·5
1912-13	7,403,922	84·3	16·3	2,267,418	33·6	5·2	1,347,491	68·3	9·7	1,030,025	56·4	15·7

It will be recollected that the board accordingly, in the early part of last year, addressed a circular letter to the councils of administrative counties, non-county boroughs, urban and rural districts in England and Wales, inviting their assistance in the classification of all existing highways into three classes—(1) first class, (2) second class, and (3) all other roads. The information asked for was readily furnished by the highway authorities, and particulars have already been received from all counties, except Devonshire, Middlesex and Wiltshire, which will enable a provisional classification of roads to be made, as soon as the traffic returns which are necessary for the completion of the classification of a large number of roads which may be described as being on the border lines of different classes, have been obtained.

The work of taking statistics of traffic at the selected points was suspended by circular issued in August, 1914, as it was obvious that the disturbance in the normal movement of traffic on many roads in many districts created by war conditions would impair the usefulness of any traffic census taken under these conditions. The preparation of the classification is consequently in abeyance for the present.

SPECIAL WORK FOR THE WAR OFFICE.

After the outbreak of war the board undertook, at the request of the Army Council, (1) to supervise and arrange for the construction and maintenance, at the cost of the Army Council, of certain new roads, and the improvement of certain private roads in several districts required for military purposes in connection with camps and otherwise; (2) to arrange with highway authorities in several parts of the country for improvements on public roads, mainly at the cost of the Army Council, required for military purposes, and to supervise the execution of the improvements required; (3) to settle by negotiation with highway authorities the amounts payable by the Army Council in respect of damage caused by extraordinary traffic in connection with military movements. In some cases the improvements required are desirable in the interests of ordinary public traffic, and in such cases the board and the highway authorities concerned are contributing to the expenditure. The aggregate amount of the estimated cost of the improvements on public roads which have been executed or are in progress up to June 30, 1915, and the contributions thereto of all the authorities concerned are shown in a table which gives the total estimated cost of works mentioned above under (2) as £475,669, made up by contributions from the Army Council, £383,070; highway authorities, £30,591; Road Board, £62,008.

In August last, in connection with a rearrangement of the duties of some of the staff, the board appointed their chief engineer, Mr. H. P. Maybury, M.INST.C.E., as manager and engineer.

Nine members of the ordinary staff of the board, including the assistant secretary, who obtained a commission as Lieutenant in the 16th West Yorkshire Regiment, and four members of the temporary staff, who were engaged on work connected with the classification of roads, are now serving with H.M. Forces.

The Need for Prudent Economy.—At a meeting recently of the Road Committee of the Deer District of Aberdeenshire, the road surveyor, Mr. George Barry, stated that the sum of £1,100 could be saved on the main roads in the district. He did not think it wise to economise too much, as they might in the near future have to spend as much as they saved. Mr. Sleigh said the roads were in excellent condition, but it was very difficult to get them into good repair once they were let down.

Women Park-keepers.—The Parks Committee of the Leeds Corporation are employing half a dozen women as keepers in the city's large park at Roundhay, to replace men who have enlisted. The experiment is proving quite successful, and more women are likely to be employed in similar capacities if the occasion arises. They are given only light duties to perform, commence work at 8 a.m., and finish at 5 p.m., and are allowed an hour for dinner. Their wages average 16s. 6d. per week. The women themselves declare that they are enjoying the experience, and say that the healthy outdoor life is much preferable to being confined to the house with household duties.

Fire Brigade Organisation and Equipment.*

By W. AUGUSTUS FARNHAM, Assoc.M.Inst.C.E., F.S.I., Surveyor to the Foots Cray Urban District Council, Sidcup.

Before proceeding with the subject, the author would state that it is not his intention to deal with urban areas exceeding 100,000 in population, for the [illegible] reasons:

(1) Holding the opinion that the proper administrative unit for fire protection purposes should be the county, he feels that such districts should either now possess or seek to obtain county borough powers, and thereby become self-contained units in themselves.

(2) While considering that the municipal engineer should generally be the executive head of the fire department, he is of opinion that in such large areas the work involved is so extensive as to demand the services of a specialist, and that such areas, by reason of their rateable value, are in a position to adequately pay for same; or, to put it briefly, that their fire engineer, like their water and electrical engineer, should control his separate department.

EXISTING LEGISLATION.

In dealing with this matter, the author would draw attention to the existing unsatisfactory conditions, the law thereon being covered by the Watching and Lighting Act, 1833, the Towns Police Clauses Act, 1847, the Parish Fire Engines Act, 1898, the Public Health Acts Amendment Act, 1907; but be it noted that, so far as England is concerned, there is no legal obligation imposed on any local authority to maintain a fire brigade in any shape or form.

The result of this condition of affairs is that, while in some districts the authorities have undertaken their responsibilities in a liberal spirit, their neighbours have done nothing, relying in times of necessity on the generosity of the former for services towards which they have not contributed one single penny; and in this respect it will be generally found that the rural authorities are the greatest offenders.

Again, there exist numerous so-called "volunteer fire brigades," which are, to all intents and purposes, "voluntary" in name only, their equipment being generally provided by the public-spirited and generous members of the community, and payment for services rendered being obtained by *ex gratia* allowances from the fire offices involved; here again is a case of parsimony evading its just liabilities.

A further defect in the present system is that a number of adjacent districts may each maintain a brigade, all ill-equipped, where, by systematic combination, one efficient brigade might suffice, and be provided at less cost.

SUGGESTED LEGISLATION.

To remedy the present defects the author makes the following suggestions:—

The county council should be the rating authority for fire protection purposes, in the same way that they now are for the police, but excluded from the executive powers they enjoy in the case of the latter.

The counties should be divided into fire areas, the rural parts being served from their most convenient urban centre, and all such centres being in telephonic communication and mutually assisting each other when circumstances so require.

The upkeep of the brigades should be defrayed from the county funds, the grants being apportioned on the basis of the rateable value of the respective areas, and the grants being conditional on satisfactory efficiency being maintained, in a similar way that grants are now made to the urban authorities in respect of main roads.

The brigades should be inspected periodically by an officer from a department of State—preferably the Home Office or the Local Government Board—and such officer should be the arbitrator in all matters of difference between the county and the maintaining authority.

It may well be that in some urban areas circumstances may exist which require additional protection beyond that provided for from the county funds, and for that reason authorities should be empowered to contribute from their local funds such extra cost as they may deem necessary.

While on the subject of finance, may the author express his views on the debatable question, "Should fire insurance companies contribute to the cost of fire protection?" He unhesitatingly says "No!" and advances the following arguments in support of his opinion: They are trading undertakings, and should apportion their premiums in proportion to their risks; life insurance offices are not asked to contribute to the cost of public health measures, or marine insurance offices to the maintenance of lighthouses or lightships; moreover, in his experience it is generally the most ill-equipped brigades who expect the largest contributions from the fire offices, and conversely the best equipped who advance the smallest claims.

ORGANISATION.

In commercial life, if an undertaking is to be a success, the first essential is a manager who, by technical training and experience, is intimately acquainted with its every process, combined with ability to organise and handle its staff and workmen.

These qualifications equally apply to the fire service, and such a manager should be a brigade chief officer. We will now examine the special qualifications required: Ability to organise and discipline; knowledge of fires and their causes; local government law; building construction and dangerous structures; electricity; fire appliances, especially pumps, hydrants, hose, ladders, &c.; motor and horse traction; hydraulics.

On comparing the above with the "Synopsis of the Work of a Municipal Engineer," compiled for this institution by Mr. H. Percy Boulnois, it will be seen that the municipal engineer's training, and his alone, covers these varied qualifications; moreover, he, above all others, should be in attendance on the occasion of fire for many obvious reasons.

PERSONNEL.

For this purpose—also for the consideration of the number of stations required—the author proposes dividing districts into three classes: (*a*) Those approximating to 100,000 population, (*b*) 50,000 population, (*c*) 20,000 population and under.

Dealing with class (*a*), if of a manufacturing character, it may require three stations; otherwise two properly situated may suffice. Class (*b*), unless of a widely scattered character, may well be served from one centrally situated. Class (*c*), one will in all cases suffice.

In class (*a*) the staff under the chief officer should be as follows: A superintendent acting as second officer, and for each station two permanent and from ten to twelve retained men.

Class (*b*): At the chief station one working superintendent and one permanent and from fourteen to sixteen retained men; sub-station, one permanent and ten retained men.

Class (*c*): This is by far the larger type throughout the country, and, generally by reason of the lower rateable value protected, will require the most economic handling.

The following are the author's suggestions: Where possible, the municipal offices, fire brigade station, and the depot should be grouped together. One of the permanent staff—say the road foreman—should reside on the premises, and act as superintendent, and be generally available after working hours. During the day one of the employees can perform the combined duties of fireman, office caretaker and storekeeper, and the duties will not be found excessive. In addition, there should be fourteen retained men.

In all three classes of districts the retained men may be utilised for relief duties, for example.

In a station with two permanent men, the latter may share twenty hours of the day in watches, and the hours from 7 p.m. to 11 p.m., as well as Sunday relief, may be performed by the retained men in rotation.

From observation the author has found this system work far better than a small permanent staff, with its attendant relief difficulties.

With regard to the type for permanent men, he is not in favour of those trained in the large city brigades. He has found that those generally obtainable have been discharged therefrom either on account of age or unsuitability; moreover, they generally

* Paper presented at the [illegible] meeting of the Institution of Municipal and County Engineers.

The Surveyor
And Municipal and County Engineer.

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Experienced men, in the way of appliances, are only used to their particular type of same, and are invariably apt to quote what they did when at so-and-so instead of adapting themselves to their new surroundings.

The author considers that more suitable men can be obtained from among the personally trained men. Retained men should be recruited from either the small shopkeeper, mechanic or intelligent labouring class. He has found that, if properly trained, the printer is as good as the bricklayer, the nurseryman as good as the labourer, the shopkeeper as good as the carpenter. All that is required is intelligence, activity and health. Age upon joining, say, from eighteen to thirty years, and, unless promoted to an officer, leaving at from forty-five to fifty.

In all cases before appointment they should undergo a strict medical examination.

FIRE STATIONS.

These would be centrally situated in a prominent position, and opening on to a wide road, the minimum accommodation being as follows:—

An engine-room, not less than 30 ft. square, two main doors, not less than 9 ft. 6 in. wide and 11 ft. 6 in. high, provided with quick opening apparatus, and an ordinary door for visitors.

A watch-room adjoining for the electrical instruments; size not less than 8 ft. square.

A bath-room, lavatory, and a water-closet.

A recreation-room, not less than 22 ft. by 18 ft.

For each resident man a large living-room, a small scullery containing a kitchener, one large and two small bedrooms, a small larder and coal store, and one water-closet may suffice for two families where space is limited.

The quarters should be approached by a separate door and staircase from the rest of the building.

Another important adjunct is a hose-drying and drill tower, which may occupy one corner and the full height of the building. This may accommodate at the bottom the furnace for serving the engine-room radiators, and for providing a hot-water supply; the heat radiated from the furnace will also assist in drying hose during the winter months.

ALARMS AND CALL BELLS.

These are, perhaps, the most important of the equipment, seeing that a quick call and turn-out is everything if the fireman's duty of preventing rather than extinguishing serious fires is to be efficiently performed, and the author would emphasise the fact that a brigade's efficiency should be judged by the small number, and not the large number, of serious fires.

The essential qualifications in these are as follow:—

(*a*) Reliability under all circumstances, especially from defects due to line or instrumental faults. As a protection against the former, he prefers a system of duplicate wiring.

(*b*) Provision for testing without leaving the station, and serious defects such as bad earths or line shortages, giving both visual and audible indication of their occurrence, cause and approximate position.

(*c*) Audible and visual discrimination between real and false alarms, thereby avoiding the annoyance and work incidental to an unnecessary turn-out.

(In passing he would state that there is no means of preventing malicious alarms, although a loud sounding bell in the call post will minimise them.)

(*d*) The system should include a telephone apparatus for transmitting brigade messages from the call points to the station, and for this the author prefers the "fixed" rather than the "portable" receiver and transmitter.

(*e*) A great advantage is obtained if the system is directly connected through the station to the call bells, especially if of a coded type, indicating to the men the point from which the call is given, thereby often saving them a large expenditure of time and energy running in a wrong direction.

Before leaving this subject the author would remind his hearers that a defective alarm is worse than none at all, as it leaves the caller ignorant of the fact that the brigade have not been warned.

CALL BELLS.

The essentials to a satisfactory system are:—

(*a*) Reliability against faults or breakdowns.

(*b*) Positive discrimination between line faults and legitimate calls, and this can generally be secured by a distinctive and characteristic type of ring in each case.

(*c*) Provision for telephonic communication between the stations and the men's residences, and through the former from the latter to the alarm points.

To some this may appear an unnecessary expenditure, but in practice it has been found not only most useful, but actually economical, inasmuch that for the small cost of the instrument each man's house is converted into a call point.

TRACTION.

Before dealing with appliances the method of traction must be considered, and undoubtedly this should be mechanical. There are at present three types in use:—

Electric.—This has certain advantages, but is generally only adaptable in large cities where proper arrangements can be made for charging accumulators, and, moreover, these latter are heavy.

Steam.—This has reliability, but the advantage is outweighed by the time lost in raising, or alternatively by the cost of constantly maintaining sufficient pressure to get under way.

The Petrol Motor.—This is certainly the most suitable, and it has now reached such a state of reliability as to place it before the horse in this respect, while for both speed in starting and transit the latter is quite outdistanced. It is simple to handle, and no difficulty is found in training the veriest novice in driving.

In passing, the author would issue a warning against excessive speeds. Twenty-five miles an hour is ample; higher may lead to accidents, and is not conducive to reliability; but speed must not be confused with hill-climbing ability. In his opinion, the ideal would be a machine capable of takng a fairly stiff hill without appreciable reduction in speed.

THE MOTOR ESCAPE AND HOSE TENDER.

A fire brigade is essentially a life brigade first. No station should be without an escape and hose tender as a first turn-out machine, and the tendency outside the large cities to give the engine the only consideration is to be regretted. In the author's experience, given an average water pressure, this machine will deal with 95 per cent of the fires, and if provided with chemical extincteurs (of which he prefers two of the 5-gallon portable type to each machine), and provided a call is quickly given and answered, they alone will deal with 75 per cent of the calls.

The escape should be constructed as lightly as is consistent with strength, should be capable of being hand-propelled in a horizontal position, and neither too short nor too long for its purpose; the latter fault is more frequent than the former. A 40-ft. machine is ample for a three-storey building.

It should be constructed so that either the whole or part of the ladders can be detached and worked independently of the carriage if so required.

The motor should also be equipped with the following: One or two hook ladders, not less than 800 ft of unlined and 200 ft. of rubber-lined canvas hose of

2½-in. diameter (the lined lengths for use next the branch pipes to minimise water damage), two standpipes and branches, and the usual minor accessories.

ENGINES AND PUMPS.

The author's observations as to traction equally apply to power, for pumps the petrol motor is easily first.

The most suitable type of pump has during recent years been a continuous source of controversy, some favouring the reciprocating, others the turbine, or, to give it its more correct name, the high-pressure centrifugal; but it has been principally a makers' agitation, each trying to boom his own particular type. After a lengthy study he has come to the conclusion that it is mainly a question of local conditions; each has its advantages under certain circumstances, but that in the majority of cases the advantages are with the turbine.

A more important, but often overlooked, matter is that of capacity, and here again the tendency is to adopt too large a machine. Except in towns possessing rivers, docks or other similar large sources of water supply, the author is convinced that a pump with an output of 220 gallons per minute is ample; it will utilise all the water obtainable from two normal hydrants, and is more easily throttled down where the water supply is limited, as in the case of country fires or small mains. Such a pump can be driven by an engine of 35-b.h.p., and this power will be ample for traction purposes. This machine should also carry 1,000 ft. of 2½-in. canvas hose, as well as the usual minor accessories, and a light ladder extending to, say, 30 ft. is a most useful appliance. Before closing the subject of appliances, the author would mention two most important items for a quick turnout:—

First, all motors should be equipped with either a self-starter or, alternatively, with accumulator and coil ignition attached through duplicate plugs to each cylinder, in addition to the magneto, as even the best of these latter are liable to be slow on a cold night.

Secondly, the lamps should be of an instantaneous lighting type, either from an electric self-lighting set, from the accumulators supplying the secondary ignition, or from dissolved acetylene cylinders. Small, portable, self-contained acetylene lamps should be provided as a stand-by; moreover, they make a useful tool when searching awkward places.

In conclusion, the author hopes that his efforts have produced a new and useful subject for discussion, and that they may induce more of the members to take an active part in what he has found to be an interesting and useful municipal duty.

Aberdeen Burgh Surveyorship.—The Aberdeen City Council discussed recently at considerable length a report by the Finance Committee on the subject of the vacant burgh surveyorship, and eventually an amendment was passed in the following terms: "That the appointment of a burgh surveyor be deferred till after the termination of the war, the assistant surveyor, with such staff as may be necessary, to carry on the work meantime, and that a special committee be appointed, along with the City Chamberlain, to prepare, for the information of the council, a statement, financial and otherwise, supplying details of the number of officials in the employment of the burgh surveyor's department, their respective duties and salaries, and other expenditure of the department; this printed statement to furnish particulars of the saving to be effected by amalgamating the water department with the burgh surveyor's department."

Rhymney Valley Sewerage Works.—At a meeting of the Sewerage Board this week, a report on a recent deputation of members to the Treasury was presented. Mr. Edgar Davies (Bedwellty) had a motion to consider the advisability of economising in expenditure for the supervision of the works, but the chairman asked Mr. Davies to defer the motion. Mr. Davies said the scheme, when completed, would cost over £300,000. He thought the board should dispense with the services of two resident engineers. He would agree, however, to bring the motion forward at the next meeting. Mr. R. J. Jones (Bedwellty) complained that one of the engineers recently refused to tell him when he last visited the works. The public of the Valley would think the members absolute puppets if they could not get an answer to a simple question like that. It seemed that all they had to do was to "sit tight and sign cheques." Mr. J. S. Alford, the engineer referred to, said he did not mind answering the question as a matter of courtesy, but he objected on principle.

SEWAGE PURIFICATION AT WOLVERHAMPTON.

By William Clifford, Assoc.M.Inst.C.E., Manager and Chemist.

[The following particulars are extracted from Mr. Clifford's report on the work of purification at the Barnhurst works during the year ended March 31st last.]

The total volume of liquid treated is estimated at 1,380 million gallons, of which the greater portion (1,326 million gallons) arrived by the low-level sewer, and was lime-treated before passing on to the land. The remainder (54,000,000 gallons), which arrived by the high-level sewer, was merely settled—no lime being added—before the land treatment. The average dry-weather flow is slightly over 3,000,000 gallons per day. The increase due to new connections to the sewers is about 1 per cent.

The storm water was unusually heavy and continuous during December; the maximum flow, however, occurred on June 18, 1914.

During the year the rate of flow exceeded six times the dry-weather flow on seventeen occasions, which lasted altogether some fifty-one hours. The flow exceeded three times the dry-weather flow for 342 hours.

The rainfall (33·818 in.) was much above the average.

An item which calls for comment is the galvanisers' refuse. The presence of iron in the sewage was noted on 312 days. The total amount of this form of refuse does not appear to have varied much during the last five or six years.

The amount of lime added to the low-level sewage has averaged 4·4 grains per gallon on the dry-weather flow. The total amount used during the year is 293 tons, which is nearly the average of the past six years.

Some 32,000 tons of wet sludge (90 per cent moisture) and 300 tons of detritus (50 per cent moisture) were obtained from the sewage. The increase of sludge due to pan conversions* is not, as yet, very pronounced.

The pressing of sludge as a preliminary process to disposal was discontinued early in May, 1913. The sludge is now utilised as a manure for crops on the high-level land, and on some of the adjoining farm land. Instead of carting the pressed sludge as hitherto, the wet sludge is forced through light iron pipes laid on the surface to the fields direct, and spread by means of grips or gutters arranged to utilise the fall of the land.

During the four months May to August inclusive the sludge is disposed of on several plots (7 or 8 acres altogether) kept fallow for that purpose.

Some 20,000 tons of the wet sludge were irrigated on various fields; the remainder was air-dried on the spare plots.

The disposal by boat of old pressed sludge from the tip, and of air-dried sludge collected from the spare plots, amounted to 2,829 tons.

ANALYSES AND RESULTS.

The mean strength of the raw sewage calculated by the formula [4·5 (Amm.N.+2 Alb.N.)+6·5, O. Abs.] is 93·6, as against 86·7 last year. The increase in "strength" (8 per cent) is no doubt due to the large number of water-closets connected to the sewers.

Lime treatment and sedimentation effected the removal of impurity to the extent of 48·3 per cent, as measured by the albuminoid nitrogen, and 42·4 on the oxygen absorption. The corresponding figures last year were 48·4 per cent and 39·2 per cent.

Taking the average of the land samples as representing the average quality of the final effluent, the total purification effected by precipitation and land filtration is 95·8 per cent on the albuminoid nitrogen and 95·0 per cent on the oxygen absorption. The corresponding figures last year were 96·5 per cent and 93·5 per cent.

COST.

The nett cost of purifying the sewage, exclusive of interest and sinking fund on capital account, is £2,452, or 6·14d. per head of population.

County Council's Economy.—At a meeting of Donegal County Council on Tuesday the report of a sub-committee recommending increases of salaries to seven members of the office staff, three heads of the departments, and the county surveyor for the southern division, was considered. Mr. Francis Callagher, J.P., moved that the report be postponed for twelve months. He said that was no time to add fresh obligations to the ratepayers. The motion was passed.

* Some 3,000 pan closets have been abolished during the year.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

Mr. J. G. Wilkin, of Downpatrick, [illegible] has chosen "Practical Bridge and Roof Carpentry," by Jas. Dredge, and "Practical Sanitary Plumbing, Drainage and Sewer Dimensions," &c., by C. E. Housden (Longmans).

"Practical Mensuration," by F. Noel Taylor (Griffin).

"Elements of Structures," by Arthur Morley (Longmans).

QUESTIONS.

This week answers are invited to the following questions:—

497. Gauging Sewers.—Describe a suitable method for gauging the flow of sewers.

498. Buttress Design.—Thirty feet (30 ft.) above the ground a rectangular buttress bears a thrust of 5,000 lb. inclined at an angle of 45 deg. If the buttress is to be 3 ft. wide, and is built of masonry 140 lb. per cubic foot, find its thickness. Also find the height of a turret 3 ft. by 3ft. necessary for stability at the top point if the coefficient of friction 0·60. (E. P. C., *Birmingham.*)

499. Geodesy.—Describe generally (without details) the astronomical observations needed to locate the starting-point of a survey in a new country. (E. P. C., *Birmingham.*)

500. Sewage Tank.—A sewer discharging into a sea outfall is connected to a storage tank l feet in length, b feet in breadth, and h feet in height. The tank discharges directly into the sea by means of an orifice a square foot in area, connected to low-water level by a short pipe of the same area, the top of the tank being at high-water level. Neglecting losses due to friction, and assuming that no sewage is admitted to the tank during the period of emptying, that the tide has a range of r feet, and that the tide curve is harmonic, find approximately the time taken to empty the tank. (Stud.Inst.C.E.)

501. Ventilation.—In designing a system of ventilation for a public hall, what are the relative advantages of a small number of large inlet shafts, compared with a large number of small shafts; and at what level should these inlets be placed? (C. W. P., *Wellington.*)

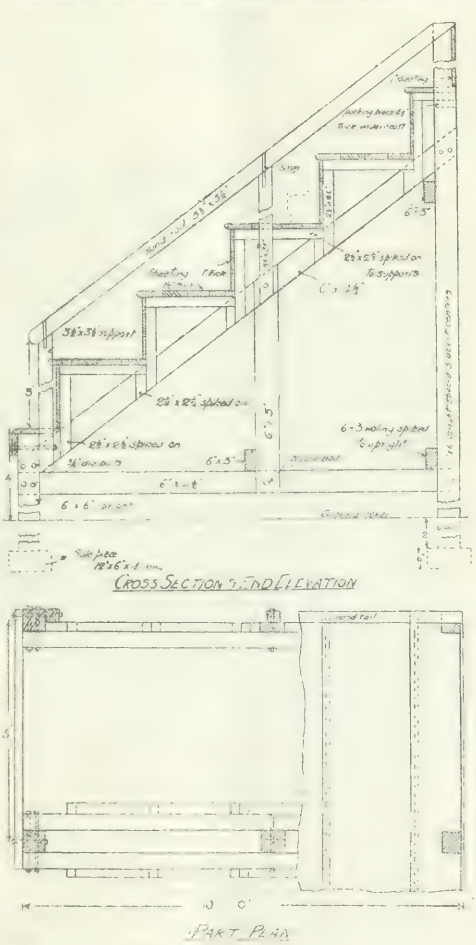
502. Theory of Beams.—The cross-section of a beam is T-shaped, the upper table is 6 in. wide and 1 in. thick, the vertical web is 5 in. deep and ¾ in. thick. At a certain cross-section this beam is subjected to a known bending moment. Make a careful sketch to show the distribution of the stress across the section [illegible]. (C. W. P., *Wellington.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

496. Stand for Procession.—A stand with seats is required, from which to view a procession, upon a site 40 ft. by 10 ft. The front is to be 4 ft. above pavement behind some iron railings. Give section and part plan to a ¼-in. scale.

Since this is only a temporary structure, it must not be assumed that a light construction will suffice. The scantlings should be of such dimensions and put together in such a manner as to preclude all risk of collapse, and consequent danger to human life. A crowd of excited people on a stand must be considered as a live load, and a liberal factor of safety must of necessity be employed. The cross-section and plan illustrated is designed with a factor of safety adequate for security, and at the same time an endeavour is made to keep the cost at a low figure. Access to the stand can be made by means of three or four steps (not shown), which could probably be placed in the gateway through the iron railings, and a line of steps, about 9 in. by 9 in. and 3 ft. wide, can be used for passing up and

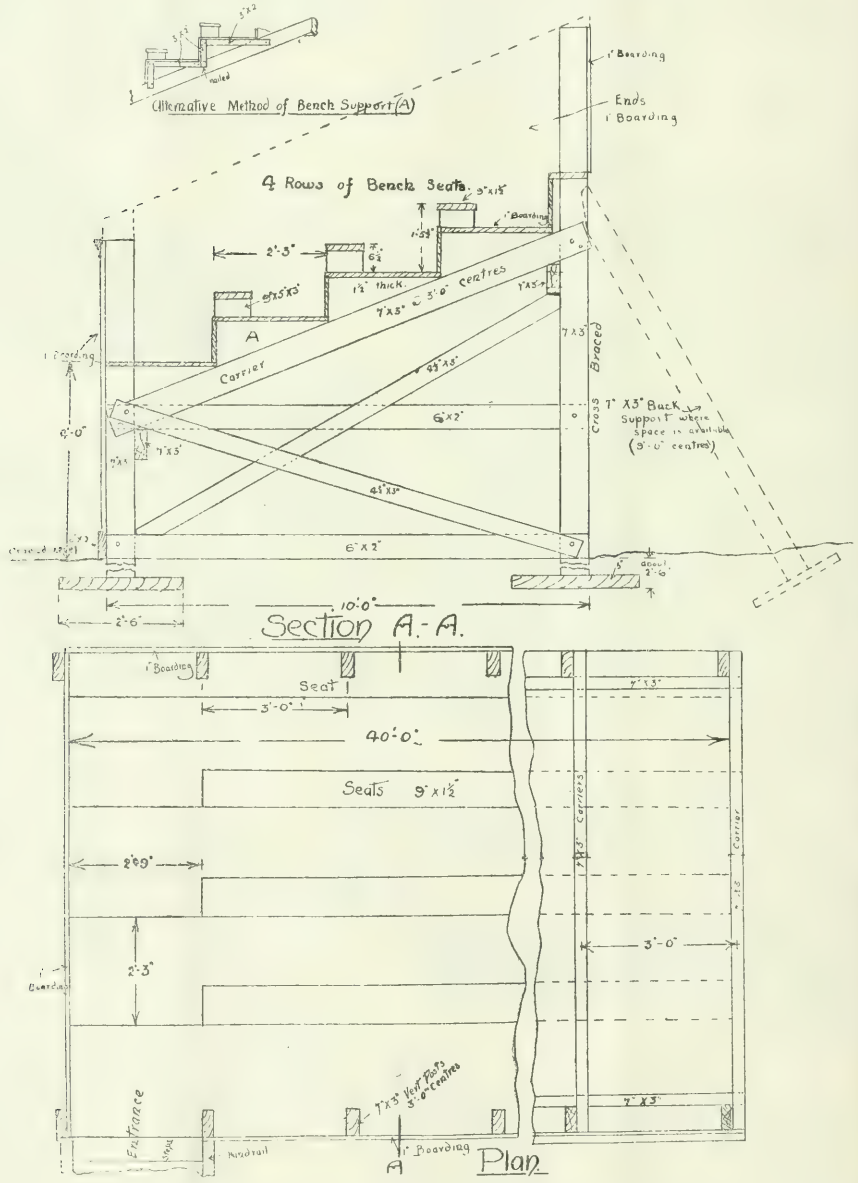


down the stand. One such step is shown in dotted lines between the third and fourth row of seats in the cross-section.

Undoubtedly it is desirable that the stand should cost as little as possible consistent with security, and in that case good, sound, sawn spruce would be the cheapest timber for its construction. (J. G. W., *Downpatrick.*)

Sketch No. 1 shows a cross-section taken through the centre of the stand. Sketch No. 2, part plans showing (*a*) plan of benches, (*b*) plan of carriers. In these sketches it is assumed that the stand is required only for temporary purposes, and therefore the idea throughout has been to waste as little timber by cutting, &c., as possible. The entrance to the stand is on the extreme left-hand side, by means of steps 2 ft. 9 in. wide. The benches are secured on to triangular blocks of timber 2 ft. 3 in.

by 11 in. by 1½ in., which are spiked or notched on to the carriers. Instead of these pieces of wood, a frame similar to sketch A would be suitable, which consists of 3-in. by 2-in. spars, nailed, horizontal and vertical to carriers. The carriers are 7 in. by 3 in., at 3-ft. centres, and are bolted to the vertical posts, or may be securely nailed to save boring. Particular care should be taken to cross-brace the back of the stand with, say, 6-in. by 2-in. spars, which will add considerably to the stiffness of the structure. Where space will permit at the back of the stand, "back supports" or struts should be provided (especially where subject to considerable wind pressure) at every 9 ft. or every third vertical posts, say of 7-in. by 3-in. stuff, with a sole piece fixed at the bottom into the ground, as shown in dotted lines in sketch No. 1. This will prevent overturning. Where a covered stand is required, the vertical posts may be continued upwards for about 18 ft. above ground level, and a collar roof formed and cross-braced. The principals should not be at a greater distance than 15-ft. centres; therefore, in this example, three principals would be required—viz., one at each end and one in the centre. As it is only for temporary purposes, a canvas covering will be all that is required. (E. H., *Walkden.*)



495. Radius of Gyration.—Explain from first principles the precise meaning and significance of the term "radius of gyration" as used in the investigation of the theory of beams.

The moment of a plane area about a line in its plane is the limit of the sum of the products of small elements of the area and their perpendicular distances from that line. In Fig. 1, if δA represents any element of a plane area A distant y from any line OX in its plane, the moment of the area is the limiting value of $\Sigma y \delta A$; similarly the moment of the area round OY is the limiting value of $\Sigma x \delta A$.

The centroid of a plane area (also called the centre

of gravity) may be defined as a point in its plane such that the moment of the area about any line in the plane passing through that point is zero, or for any line lying in the plane through the centroid the product-sum $\sum y \delta A = 0$. Such a line through the centroid is called the neutral axis of the figure. The moment of inertia I, or the

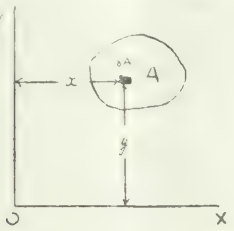


Fig. 1.

second moment of the area about any axis in its plane, is defined by the relation $I = \sum y^2 \delta A$, where the values of y are the distances of the elements of area δA from the axis about which the quantity I is to be determined. If A be the area of any plane figure, and I its moment of inertia about any axis in its plane, the radius of gyration K of the area about that axis is determined by the relation

$$K^2 A = I = \sum y^2 \delta A \quad \text{or} \quad K^2 = \frac{I}{A}$$

or K is that value of y at which, if the area A were concentrated, the moment of I would be the same as that of the actual figure. For calculating the moment of I, and consequently the radius of gyration of simple figures, such as rectangles and circles, the following theorem is useful: The moment of I of any plane figure about any axis in its plane exceeds that about a parallel plane through the centroid by an amount equal to the product of the area and the square of the distance of the centroid from the axis. If I is the moment of inertia of an area about any axis in its plane, and I_0 is the moment of inertia about a parallel plane through the centroid and l is the distance between the two axes, $I = I_0 + l^2 A$, or by dividing each by A we get from above $K^2 = K^2_0 + l^2$, where K is radius of gyration about an axis distant l from the centroid, and K^2_0 that about a parallel axis through the centroid. This theorem is easily proved—

$$I = \sum (l + y)^2 \delta A = \sum (l^2 + 2ly + y^2) \delta A$$
$$= l^2 \sum \delta A + 2l \sum y \delta A + \sum y^2 \delta A$$
$$= l^2 A + 0 + I_0 \text{ where } y \text{ is measured from an axis through the centroid}$$

(1) Let it be required to find the moment of inertia and radius of gyration of the rectangular area ABCD

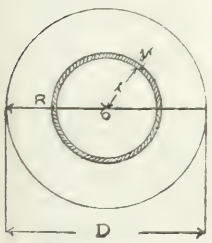


Fig. 2.

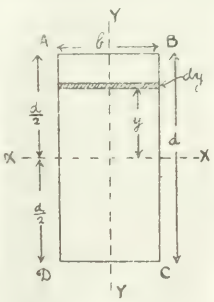


Fig. 3.

about the axis XX, in Fig. II. Take an elemental strip of area $b.dy$.

$$I_{XX} = \int_{-\frac{d}{2}}^{\frac{d}{2}} y^2 b dy = b \int_{-\frac{d}{2}}^{\frac{d}{2}} y^2 = \frac{b}{3}\left[y^3\right]_{-\frac{d}{2}}^{\frac{d}{2}} = \frac{1}{12} bd^3$$

and $K^2 = \frac{I}{A} \quad \therefore K^2 = \frac{\frac{1}{12} bd^3}{bd} = \frac{1}{12} d^2$ or $K = d\sqrt{\frac{1}{12}}$.

(2) Required to find moment of I and K round DC

$$I_{DC} = I_{XX} + bd\left(\frac{d}{2}\right)^2 = \frac{1}{12} bd^3 + \frac{1}{4} bd^3 = \frac{1}{3} bd^3$$

Or this could be found simply thus –

$$I_{DC} = \int_0^d b y^2 dy = \frac{b}{3}\left[y^3\right]_0^d = \frac{1}{3} bd^3$$

and $K^2 = \frac{1}{A} \cdot \frac{I}{bd} = \frac{\frac{1}{3} bd^3}{bd} = \frac{1}{3} d^2 \quad \therefore K = d\sqrt{\frac{1}{3}}$

(3) Required to find moment of inertia and K round an axis through the centre perpendicular to the circular surface in Fig. III.

Take circular strip of radius v and width dv.

$$I_{00} = \int_0^R \gamma^2 2\pi\gamma \, d\gamma = 2\pi \int_0^R \gamma^3 d\gamma = 2\pi \left[\frac{\gamma^4}{4}\right]_0^R = \frac{\pi}{2} R^4$$

and $K^2 = \frac{I}{A} = \frac{\frac{\pi R^4}{2}}{\pi R^2} = \frac{R^2}{2}$

$\therefore K = R\sqrt{\frac{1}{2}}$

(J. G. W., *Dumpatrick.*)

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Christchurch T.C. (August 18th. Mr. F. H. Tulloch). £800 for surface-water drainage and the sewerage of the added areas. The necessary details of the schemes were submitted by the borough surveyor, Mr. H. J. Farmer.

Lutterworth R.D.C. (August 18th. Mr. A. W. Brightmore).– £3,400 for the purchase of the water-works undertaking of the Lutterworth Freehold Land, Building, and Waterworks Company.—The clerk, Mr. T. C. Bodycote, stated that negotiations for the purchase of the works had been going on for several years. The original price fixed by the vendors was £8,000, the amount being based upon the actual cost of the buildings and land, and the laying of mains. There had been several probable purchasers, but the council and committee were desirous that no outsider should come in and purchase, as had been several times threatened. Mr. S. H. Sands, engineer, Nottingham, gave evidence as to the capacity of the well and the pumping arrangements. He had tested the strata, and understood there had been no falling off in the supply. There would be slight fluctuations due to the rainfall, but there was fairly good evidence that the supply was permanent. He had tested the pumps and engines, and all were working satisfactorily. Dr. O'Connor, medical officer of health, stated that the only part of the scheme which did not meet his wishes fully was the rather excessive proportion of nitrates; otherwise the water was up to the standard generally accepted.

APPLICATIONS FOR LOANS.

Battle U.D.C.—£950 for works of sewage disposal.

Shipton-on-Stour R.D.C. — £670 for works of sewerage.

Winchester R.D.C.—£250 for pumping machinery.

LOANS SANCTIONED.

Newry U.D.C.—£770 for works of street improvement.

South Westmorland R.D.C.—£220, additional loan for sewage disposal works.

LOANS REFUSED.

Burry Port U.D.C.—£17,500 for works of sewerage.

East Lancing Sea Defence Commissioners.—£3,000 for sea defence works.

Reigate T.C.—£6,000 for the Redhill police and fire station.

FORTHCOMING INQUIRIES.

SEPTEMBER.	£
1.—**Skelmersdale.** For the provision of a new gas holder and condenser (Mr. F. H. Tulloch)	2,000

Lilian Bradshaw Fund. — Messrs. J. Edward Willcox, of the firm of Willcox & Raikes, Birmingham. £1 1s.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Bideford; housing and town planning—Dartford; roads and materials—Fareham; sewerage and sewage disposal—Wantage; water, gas and electricity—Carlisle, St. Thomas.—Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Bideford T.C.—Plans have been prepared for the erection of a joint isolation hospital for Bideford, Northam, and Abbotsham, at an estimated cost of nearly £9,000, but the council are seeking to obtain a reduction of this figure, as it is considered excessive.

Halsted U.D.C.—A scheme has been passed for the erection of an additional wing to the isolation hospital.

Thorne R.D.C.—The question of the approach to the Great Central Railway Company's station at the colliery village of Stainforth occupied the attention of the council recently. The cost of constructing a bridge was estimated by the company's engineer at £1,100, but the council's surveyor, Mr. H. Plewes, had prepared two schemes to cost £700 and £310 respectively, and it was decided that a personal interview should be sought with the company's representative, and the plans and figures placed before him.

HOUSING AND TOWN PLANNING.

Belfast T.C.—Of the 252 houses included in the town council's housing scheme, a total of 168 have been built, leaving a balance of 84 yet to be erected. The *Belfast Newsletter* states that the accommodation provided by the new houses consists of an exceptionally large and airy kitchen, a large-sized scullery, two good upstairs rooms, and a yard. The floors of the kitchen and scullery are tiled, the yards are built of concrete, and the fronts of the houses are of perforated brick, so that the dwellings are both sanitary and convenient. The new streets are wide and paved with pebbles, while a notable feature of the scheme is that the back passages of all the property are 40 ft. wide, and will be either concreted or tar-macadamed, thus providing excellent playgrounds for children. Gates will be erected at the ends of the passages, so that the dangers arising from vehicular traffic will be entirely eliminated.

Darfield U.D.C.—An intimation has been received from the Local Government Board that the proposed housing scheme cannot be sanctioned. The estimated cost is £16,218.

Dartford U.D.C.—The Housing Committee have approved the proposals of the surveyor, Mr. T. Tiffin, for a housing scheme to consist of two types of dwellings.

East Preston (Sussex) R.D.C.—With respect to the inspection of houses in the district, under the Housing and Town Planning Act, the Local Government Board wrote that they could not assent to the proposal to suspend the work of inspection. Such a policy, in the event of epidemic disease occurring in the district, might have very disastrous results. At the same time, as regards inspections, these should be mainly concerned with cases of actual nuisances, and only such action as was immediately necessary should be taken. Mr. Schweder: That practically agrees with the council's views and is exactly what they wanted. The clerk (Mr. A. Shelley) said the letter told them nothing. They asked for authority to suspend the inspections altogether. The letter was inconsistent. The Local Government Board did not approve of suspending inspections, and yet it told them, both as regards inspections and the action taken upon them, these should be mainly concerned with cases of actual nuisances. The council decided that the inspections should go on, but that owners or occupiers should not be called upon to make structural alterations, but only necessary sanitary ones.

Elland U.D.C.—The council have been requested by the Local Government Board to submit their housing scheme for the board's consideration.

Margam U.D.C.—The housing scheme, which is estimated to cost £9,703, is to be postponed.

PARKS AND OPEN SPACES.

St. Austell U.D.C.—A recreation ground of 1½ acres, presented to the council by Admiral Sir Charles J. Graves-Sawle, was formally opened recently. A composite shelter and bandstand has been presented by Sir Francis Layland-Barratt, and seats by Mr. and Mrs. Petherick, while the ground has been laid out with taste under the supervision of the surveyor, Mr. E. D. Groves.

REFUSE COLLECTION AND DISPOSAL.

Dorchester T.C.—A resolution has been passed suggesting to the inhabitants that proper movable receptacles of such size and so constructed as to enable them to be removed conveniently without leaking, spilling, or absorption of their contents, should be provided for house refuse.

Wakefield T.C.—The Local Government Board have decided not to sanction at present the proposed loan for the provision of a refuse destructor.

ROADS AND MATERIALS.

Bridgwater R.D.C.—It has been decided to contribute £1,219 towards the construction of the proposed new road at Wembdon. The Road Board have promised a grant of half the entire cost, and it is proposed that the remaining half should be borne between the county council, Bridgwater Town Council, and the rural district council.

Brigg R.D.C.—Application has been made to the Admiralty for a grant towards the cost of the proposed diversion of a road at North Killingholme.

Coleraine U.D.C.—The surveyor reported that the making of tar-macadam was very profitable so far as the council were concerned.

Colwyn Bay U.D.C.—The surveyor, Mr. W. Jones, reporting on the proposal made at the last meeting that the section of the road to Llandudno between Rhos-road and the Ship Hotel should be widened, advised that the road should be made 36 ft. wide, with a 6-ft. footpath on each side. It was further stated that there was good reason to hope that the land required would be given by the Cayley Estate. The council decided to take steps to acquire all the land needed, with a view to the widening being carried out.

Dundee T.C.—The Works Committee recommend the acceptance of the tender of Mr. T. S. Dick, at £574, for the repaving of Douglas-street.

Fareham R.D.C.—On the subject of the proposed improvement of the Southampton and Portsmouth district road and the making of the proposed new road at the top of the cliff, Hill Head, the clerk produced the conveyance of three pieces of land to the council to be executed and sealed. The council, he said, was now in a position to proceed with the road at the top of the cliff at Hill Head. The council referred the matter to the Roads and Works Committee.

Glastonbury T.C.—The borough surveyor, Mr. G. Alves, has received instructions to complete the section of new cement paving in High-street, but not to start another section at present.

Midleton (Ireland) U.D.C.—The staff of stonebreakers employed by the council recently refused to work at stonebreaking at 1s. 2d. per load, their reason for so doing being that the stones from a new quarry taken by the council were harder to break than the stones from the council's old quarry. The council have now arranged through the surveyor to have the stones in future broken by the assistant quarryman and another stonebreaker, for whom regular employment at that work will be found at 1s. 4d. per load, and dispense with the rest of the stonebreakers.

Oxfordshire C.C.—In lieu of the agreement with the Corporation of Henley-on-Thames with respect to the reconstruction with Tarmac of Marlow Station-road and Reading-road, it has been decided to substitute a grant of £370 towards the cost of resurfacing with Tarmac a portion of Bell-street, and to tar-paint all existing Tarmac surfaces.

Perth T.C.—Plans have been approved for a new street between Belhelvie-terrace and Strathearn-terrace.

Rawtenstall T.C.—The borough surveyor, Mr. J. Johnson, has prepared a scheme for widening Booth-

...ual, which is to be submitted to the county council ... a view to a grant.

Wakefield T.C.—The Local Government Board have decided not to sanction, at present, a loan of £920 for street works in connection with Westgate improvement scheme.

Waterford C.C.—A grant of £850 has been voted for the construction of a new road beside the east promenade at Tramore.

Woking U.D.C.—It is reported that the Road Board has agreed to make a grant of ½d. per square yard in respect of the surface tarring of Goldsworth-road, Pyrford, and Woking Village-road, York-road, and Connaught-road, Brookwood.—The county surveyor has agreed to the estimates of the quantity and cost of material required for the maintenance of the district roads for the year ending March 31, 1916, as follows: Guildford and Chertsey road, material £1,648, tarring £231; Woking and Cheshire road, £515, £50, £365; Woking and Ripley road, £605, £100, £705; Guildford and Bagshot road, £150, £165, £315; Knaphill and Pirbright road, £37, £45, £82; Byfleet road, £22, £7, £30.

SEWERAGE AND SEWAGE DISPOSAL.

Acton U.D.C. A further extension of sewerage is to be carried out at The Vale at an estimated cost of £500.

Battle U.D.C.—The council recently decided to carry out a scheme of sewage disposal on land at Marley, at an estimated cost of £900, subject to the granting of a loan.

Branston R.D.C.—A letter has been received from the Local Government Board declining to sanction the modified proposal for the disposal of the sewage at Boultham, and the council have referred the matter to the Rivers Pollution Committee.

Glastonbury T.C.—The council have agreed to a scheme for laying a new sewer in Old Street-road.

Wantage R.D.C.—With reference to the Harwell sewerage scheme, the council have approved a report by the Harwell Drainage Committee recommending that the scheme of land treatment be adopted, and that the storm water be separated from the sewage; that the clerk be instructed to negotiate for the purchase of 4 acres of land situate lower down the stream and about 700 yds. from the present filter tanks as an irrigation area, and that the present filter tanks be abolished; that the present sewers, which are known to be defective, be used for surface water, and that new sewers be laid throughout the parish for sewage.

WATER, GAS, AND ELECTRICITY.

Carlisle R.D.C. It has been resolved to approach the Carlisle Corporation to ascertain to what extent and upon what terms they are prepared to extend their supply into the rural district, and the lowest price at which they will sell water for the supply of those districts to which they are not prepared to extend their main.

Doncaster R.D.C.—The council have agreed to a proposal for the extension of the water main in Moss-road.

St. Thomas R.D.C.—An inspector of the Local Government Board has paid a visit to the Topsham water supply works, and he has since written to the council that the work should proceed.

South Westmorland R.D.C.—An arrangement has been made with the Manchester Corporation for supplementary supplies of water for six parishes in the rural district from the Thirlmere aqueduct, at the price of 1s. per 1,000 gallons.

Winchester R.D.C.—The tender of Messrs. Duke & Ockenden, at £236, has been accepted for an instalment of new pumping machinery at the waterworks.

MISCELLANEOUS.

Oldham T.C.—Among the accounts submitted to the Surveyors and Buildings Committee was one for the painting of the street signs, showing that two men were employed at 1s. 3d. per hour. Councillor Hague objected to the present system. He held that it was a one-man job, not a job for two men at each sign, one standing at the foot of the ladder. He suggested that either the men should go round singly, or that the work should be let by contract. The borough surveyor, Mr. E. C. Foote, said that he would see what could be done to have the work done cheaper.

PERSONAL.

Mr. F. Sargeant, surveyor to the Dover Rural District Council, is indisposed.

Mr. Eric W. H. Vallis, chief assistant in the office of the Frome engineer and surveyor, has joined the Inns of Court Officers' Training Corps.

Mr. William Walker, surveyor and inspector to the Cannock Rural District Council, has been appointed district surveyor to the Eastbourne Rural District Council.

Mr. T. W. Metcalfe, surveyor to the Bedale Rural District Council, has received leave from the council to join His Majesty's Forces. He intends joining the 233rd Field Company of the Royal Engineers.

Mr. Joseph Mallett, of Great Yarmouth, has been appointed waterworks engineer and collector to the Wivenhoe Urban District Council, in succession to Mr. R. W. Macfarlane, who has been appointed waterworks engineer at Brightlingsea.

Mr. J. T. Dewhurst has resigned his appointment as sanitary inspector and assistant surveyor to the Ruislip-Northwood Urban District Council, and the council have decided to appoint Mr. W. L. Carr, the engineer and surveyor to the council, as chief inspector of nuisances. For the present no assistant inspector of nuisances will be appointed.

Mr. F. Slaughter, surveyor to the Steyning West Rural District Council, stated at the council meeting on Tuesday that the Steyning East Council had approached him with a view of his assisting them, as their acting surveyor and inspector of nuisances (Mr. Mant) was joining H.M. forces. He stated that if he did so, he would do so entirely from patriotic purposes and not with a view of making a profit. The council decided to allow him to undertake the work.

Mr. T. L. Wishlade, roads and bridges surveyor to the Radnorshire County Council, has just completed forty years' service under this authority. At the last meeting of the Roads and Bridges Committee, and at the last meeting of the Radnor County Council, he was complimented by the chairman (Alderman C. Coltman Rogers) and other members upon holding this office for so many years, and upon the efficient and economical manner in which he always discharged his duties.

CORRESPONDENCE.

Ἓν οἶδα ὅτι οὐδὲν οἶδα.
(One man does not see everything.)
— Euripides.

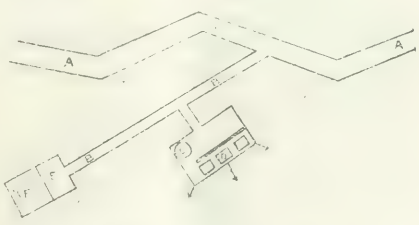
CAMP SANITATION.

To the Editor of The Surveyor.

Sir,—I am indebted to Sergeant S. C. Rigg, who in private life is sanitary inspector and surveyor to the Downham Rural District Council, for sketches and information from which the following is prepared.

SANITARY CONVENIENCES IN TRENCHES.

The sketch shows plan of firing trench with sanitary conveniences and communication trench.



AA—Firing trench.
BB—Communication trench.
C—Urinal.
D—Latrine.
E—Excreta burying.
F—Excreta buried.

Fig. 1.

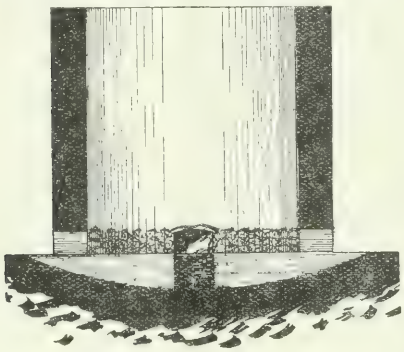
No particular type of receptacle is specified; anything watertight is adopted, as, for instance, empty 5-gallon drums, biscuit tins, and 4-gallon petrol tins. My informant emphasises the fact that a plentiful supply of disinfectant, both fluid and powder, is provided. The excreta burying ground is cut as far from

the firing line as conditions permit, and after use is filled over, as marked F on plan, and a fresh space cut as E. When this eventually approaches an inconvenient distance, the whole is filled and marked "foul ground," and trenches are cut to fresh burying grounds presumably as I have shown by arrows.

REFUSE DESTRUCTORS.

I consider the refuse destructor illustrated in Fig. 2 to be a great improvement on those formerly suggested, as it permits a continuous fire.

The description I received is as follows: "Cut out cross, as for camp kitchen, place bars (binding strips



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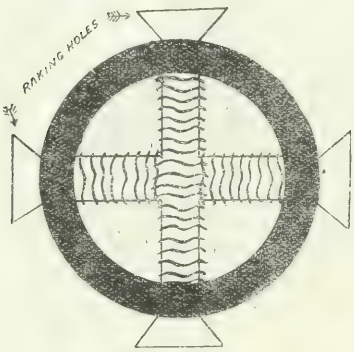


Plan.

FIG. 2.

off corrugated iron sheets) across, and build on top of this, as shown. Material for building, almost anything, such as biscuit tins filled with earth, old brick-bats, &c.

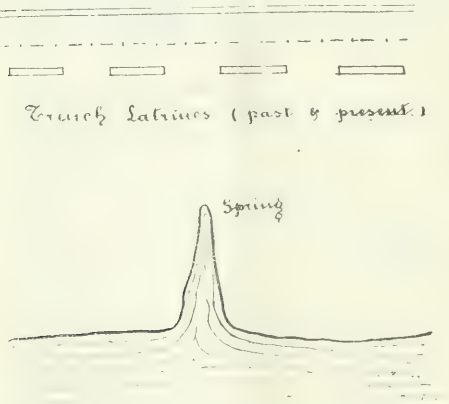


FIG. 3.

To those intending to adopt this type I suggest that flints should be packed in the angles, as shown. These, retaining heat longer than earth, would dry any wet refuse that might require destruction when the fire was low.

WATER SUPPLY.

To a correspondent who wishes to remain anonymous I am indebted for particulars of a water supply "somewhere in England," fortunately condemned before injurious results occurred (Fig. 3). I think this will be found of interest to illustrate a departure from the rules of sanitation which resulted in the pollution of water supply by camp latrines. The position of the site was such that trenches could not be adopted with safety, and the provision of movable receptacles was imperative for this particular site. The pollution of water supply necessitated the selection of another source some distance away.—Yours, &c.,

G. BERTRAM HARTFREE.

Town Hall,
Alton.
August 23, 1915.

FOR OTHER ADVERTISEMENTS
See End of Paper.

THE RURAL DISTRICT COUNCIL OF UTTOXETER.

APPOINTMENT OF SURVEYOR OF HIGHWAYS AND INSPECTOR OF NUISANCES.

Applications are invited for the above appointments; the district comprises 15 parishes.

There are about 119 miles of district roads to be superintended and maintained.

The person appointed will be required to devote the whole of his time to the duties of his office, to provide himself with means of locomotion, and to reside in the district; he will also be required to perform all the ordinary duties appertaining to the office of Inspector of Nuisances as defined by the General Order of the Local Government Board of the 13th December, 1910, and also to act as the designated officer for the purpose of the Housing (Inspector of District) Regulations, 1910.

The following offices will also be held by him—viz., Inspector under the Petroleum Acts, Inspector of Factories and Workshops and Slaughter-houses, also Inspector under the Dairies and Cowsheds Order.

The salary will be £80 per annum as Surveyor of Highways and £80 per annum as Inspector of Nuisances; the appointment as Inspector of Nuisances will be subject to the sanction of the Local Government Board.

The person appointed will be required to enter upon his duties as soon as possible, and to give approved security in the sum of £200 for the faithful discharge of those duties.

Applications (marked "Surveyor"), in the candidate's own handwriting, stating age, qualifications and previous experience, and accompanied by copies of not more than three testimonials of recent date, must be received at the Office of the undersigned not later than the first post on Monday, the 6th September next.

Canvassing Members of the Council, either directly or indirectly, will disqualify a candidate.

(By order)
FRANK F. HAWTHORN,
Clerk.

Council Offices, Uttoxeter.
August 25, 1915. (2,701)

SURVEYOR'S ASSISTANT (23), 6 years' experience, desires appointment; Lancashire or Northern Counties preferred. Surveyor, leveller, and good draughtsman. Good all-round experience. At liberty owing to reduction of staff due to war. Cert. Royal Sanitary Institute for Inspector.—Box 1,536, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (2,702)

DRONFIELD URBAN DISTRICT COUNCIL.

The above Council invite Tenders for Dark Limestone, broken to various sizes, delivered free at Dronfield Station in truck loads. Particulars can be obtained from Mr. T. H. Atkinson, Surveyor to the Council. Tenders and samples to be delivered at the Council's Office, Sheffield-road, Dronfield, not later than Wednesday, September 8, 1915. The Council do not bind themselves to accept the lowest or any Tender.

(By order)
H. N. LUCAS,
(2,700) Clerk to the Council.

Water Undertakings of England and Wales.

THE NEW GOVERNMENT RETURN.

(Conclusion.)

Full details as to the number of the sources of supply were asked for, and were generally obtained from the larger undertakers, but in many cases the smaller ones gave only meagre information. In every case the situation and nature of the source, the geological formations of each underground source, and the extent of the gathering grounds of upland surface supplies have been described, so far as the particulars given by the undertakers have permitted.

The sources of water supply are usually classified as surface supplies from lakes, ponds, rivers, streams and upland gathering grounds, and from springs and underground supplies from wells and boreholes. The supplies from natural outlets issuing from the strata as surface springs are, however, as truly underground waters as those reached by wells, and their subterranean characters are equally pronounced. In many instances the returns do not distinguish clearly between water derived from springs and water obtained from streams. The source of many streams and rivers can be traced to springs, and many rivers are largely fed by springs throughout their course. A typical instance is the river Thames. It is difficult therefore to make a scientific division of water supplies into surface and underground supplies. For practical purposes—the most important of which is a survey of the supplies of each kind at present used for drinking purposes, the population for which they are used, and the further quantities available—the most convenient division is to class lakes, ponds, rivers and streams and upland sources as surface supplies and wells and springs as underground supplies.

Lakes.—The principal natural lakes of England and Wales are situated in Cumberland, Westmorland and North Wales, and some of these have been laid under contribution for purposes of water supply. The Royal Commission appointed in 1866 to ascertain "what supply of unpolluted and wholesome water could be obtained by collecting and storing water in the high grounds of England and Wales either by the aid of natural lakes or by artificial reservoirs, &c.," considered a plan to provide the Metropolis with water from Thirlmere, Ullswater and Haweswater, with an additional supply from Bala Lake, in Merionethshire. The commissioners made an independent investigation of the quality of the water from the lakes, and found it excellent as regards softness and purity, freedom from mineral contents and organic contamination, but slightly coloured with peat. They rejected the plan partly on this latter ground, and partly because of the uncertainty of the cost, the possible stoppage of flow in the conduit, the necessity of pumping, and the consideration that the sources of supply belonged geographically to the large and increasing population in the North of England.

In 1878 Lake Thirlmere was appropriated by the corporation of Manchester by a Bill which was considered by a Select Committee of the House of Commons. They reported that the lake was a particularly favourable source of supply because of the large rainfall (about 100 in. annually), the scant population in the vicinity, and the consequent abundance and purity of the water to be derived from it, and because its elevation and situation were favourable for affording a gravitation supply to Manchester. The corporation were authorised to take 50,000,000 gallons a day from the lake. At the end of 1913 they took, according to their return, 17,800,000 gallons a day.*

Lake Vyrnwy now affords a supply of water to Liverpool, Crummock Lake to Workington, Haweswater to Penrith, and Ennerdale Lake to Whitehaven.

Rivers and Streams.—Many of the rivers and streams of England and Wales are utilised as sources of water supply, and from the return it appears that 95 local authorities, 10 joint authorities, and 34 companies obtain water from them. River Thames.—The river affording the largest quantity is the Thames, which, besides furnishing over 130,000,000 gallons a day to the Metropolitan Water Board, supplies 2,500,000 gallons to the South-West Suburban and West Surrey Companies and 1,720,000 gallons to Oxford, while of its tributaries the Lee furnishes 64,500,000 gallons to the Metropolitan Water Board, and the Kennet 3,000,000 gallons to Reading. River Severn.—The Severn supplies Worcester with 1,473,000 gallons per day, Bridgnorth with 240,000 gallons, and, in summer, Cheltenham with 649,000 gallons daily. Shrewsbury also uses 1,200,000 gallons a day of its water for purposes other than drinking. Of the tributaries of the Severn, the Avon furnishes 715,169 gallons a day to Rugby, the Chelt 991,000 gallons to Cheltenham, and the Wye 1,000,000 gallons to Hereford, while from the head waters of the river Elan, a tributary of the Wye, 72,000,000 gallons a day are available for the supply of Birmingham. River Derwent.—The river Derwent affords over 10,000,000 gallons a day to the Derwent Valley Water Board. River Tees.—The river Tees and its tributary the Balder supply 15,000,000 gallons daily to the Tees Valley Water Board; the Tees also supplies Darlington with 2,500,000 gallons daily.

Upland Surfaces.—Many undertakers rely upon water collected in reservoirs from the surface of uncultivated land, and such sources have been described in the returns as "upland surfaces," "gathering grounds," or "drainage areas." In some cases it is not possible to differentiate between supplies derived from upland surfaces and from rivers, streams, lakes, and springs, but it would appear that 136 local authorities, 11 joint authorities, and 20 companies depend upon gathering grounds for the whole or part of their supplies. Among the more important of these are the local authorities of Blackburn, Halifax, and Huddersfield, with available supplies per day of 20,973,950 gallons, 13,500,000 gallons, and 9,750,000 gallons respectively, and the Bury and District Joint Water Board, which obtains 5,962,000 gallons per day. Some undertakings with other sources derive very large quantities of water from gathering grounds, but the quantities obtained from the various sources are not always given. The local authorities include Leeds and Sheffield with available supplies per day of 30,662,025 gallons and 14,883,610 gallons (minimum estimate), and Oldham, which obtains 5,274,000 gallons per day. The Pontypridd and Rhondda Joint Water Board obtains 3,123,785 gallons per day.

Special Acts authorising the abstraction of water from upland surfaces invariably contain provision for compensating persons likely to be injured by this abstraction. Sometimes a money compensation is prescribed, but generally compensation in water, based on one-third of the mean available rainfall of three consecutive dry years. For the purpose of affording this compensation water the construction of special reservoirs, known as compensation reservoirs, is generally necessary.

Springs.—The actual number of springs from which supplies are obtained by the various undertakings is not known, but from the information in the return it appears that springs are among the sources of supply of 392 local authorities, 14 joint authorities, and 114 companies. Where the information has been supplied, the geological formations from which the water issues and the situation of the springs are stated in the return. Though widely distributed in England and Wales, springs are seldom in great enough volume at sufficient elevation for large gravitation supplies. Few of the larger undertakings rely for their supplies solely upon springs, but the borough of Portsmouth Waterworks Company obtain 8,261,000 gallons, and the Wisbech Waterworks Company supply 5,188,160 gallons of water per day from springs in chalk, while the local authorities of Lancaster and Bath each depend upon springs yielding about 2,000,000 gallons per day.

Springs, however, furnish the staple supplies of many of the smaller undertakings, and make important contributions to the supplies of many of the larger. Among these may be mentioned the Metropolitan Water Board, which obtains 1,712,000 gallons per day from the Chadwell Spring in Hertfordshire; the Staffordshire Potteries Waterworks Company obtains 2,120,000 gallons, and the Bristol Waterworks Company 1,744,000 gallons per day from springs.

Underground Sources.—Supplies from underground sources, excluding springs, are mostly obtained by means of wells and boreholes. The particulars of

* A third pipe from Thirlmere to Manchester has now been completed, and about 50,000,000 gallons a day will in future be derived from this source.

these sources given in the return vary with the details furnished by the undertakers, some of whom describe the wells as "artesian," "bored," "deep," "tube," or with "adits," "headings," "borings," &c. The actual number of wells and boreholes from which supplies are obtained is not known, but where the returns furnished by the undertakers contained such details, their depth, situation, and particulars of the water-bearing strata have been given.

For some years the supply of underground waters has been on the increase, and the proportion of underground to surface waters used has been constantly growing. Many important undertakings depend wholly upon wells or boreholes for their supplies. Of the local authorities, Kingston-upon-Hull obtains 12,304,000 gallons per day, Widnes 5,500,000 gallons, St. Helens 4,700,000 gallons, Birkenhead 4,215,356 gallons, Southampton 3,650,000 gallons, and Warrington 2,543,075 gallons. The Southport, Birkdale, and West Lancashire Water Board obtains 2,658,230 gallons daily from wells, while among the companies, Sunderland and South Shields obtains 8,520,000 gallons per day from wells and boreholes, South Essex 4,804,000 gallons, Great Grimsby 4,295,000 gallons, and Colne Valley 3,250,000 gallons. A number of undertakings with other sources also obtain large supplies from wells and boreholes, but the quantities derived from the various sources are not always given. The Metropolitan Water Board obtains 41,066,100 gallons per day from wells and borings, Nottingham 7,528,059 gallons, Croydon 4,053,698 gallons, and Wolverhampton 2,751,000 gallons, and the companies include South Staffordshire with 13,793,498 gallons, and Cambridge University and Town with 1,132,000 gallons.

The information in the return shows that 340 local authorities, 13 joint authorities, and 142 companies derive supplies from wells and boreholes.

GEOLOGICAL FORMATIONS AND SUPPLY.

The total amount of underground water supplied by piped services for domestic purposes may be put down very roughly as 285,000,000 gallons a day. This does not include supplies from surface springs, nor water obtained from standpipes.

The following table shows roughly the amount derived from each geological formation:—

	Million gallons daily.
Chalk (including over 40 millions taken by Metropolitan Water Board)	139¾
Bunter	71½
Magnesian limestone	13¼
Superficial deposits (shingle, alluvium, river, valley and plateau gravels, and glacial sand and gravels	13
Sandstones from coal measures	7
Millstone grit	6¼
Lower greensand (Folkestone and Hythe beds) ...	5¼
Keuper sandstones	4¼
Lower London tertiaries (Woolwich and Reading beds, and Thanet sands)	3¼
Carboniferous limestone	3
Ashdown sand	2¼
Lincolnshire limestone	2
Corallian beds	2
Great oolite	2
Upper greensand	1¼
Lias	1¼
Old red sandstone	1
Other formations yielding less than 1 million apiece	5¼
	285

Underground Supplies Furnished by Each County. The following table shows the approximate amount of water derived from underground sources in each county, and the principal formations from which it is obtained:—

	Million gallons daily.
Kent.—Including 28 millions from chalk (of which 17 millions are taken by Metropolitan Water Board) and 2 millions from lower greensand	32
Staffordshire.—Including 26½ millions from bunter and 1 million from keuper... ...	29
Yorkshire.—Including 13¼ millions from chalk, 2 millions from bunter, 1¾ millions from corallian beds, and 1½ millions from coal measures	20¼
Hertfordshire.—Almost entirely derived from chalk (over 7 millions of which are taken by Metropolitan Water Board) ...	19
Lancashire.—Nearly 16 millions from bunter, and over a million apiece from coal measures and millstone grit ...	18¼
Sussex.—Including 11 millions from chalk, 2 millions from Ashdown sand, and ¼ million from Tunbridge Wells sands	14½
Essex.—Including 11½ millions from chalk (of which 4½ millions are taken by Metropolitan Water Board) and 2½ millions from lower London tertiaries	14¼
Surrey.—Including 11¾ millions from chalk and 1¼ millions from lower greensand	13¾
Durham.—Including 12½ millions from magnesian limestone...	13½
Nottinghamshire.—Including 12½ millions from bunter	13
Hampshire.—Including nearly 11 millions from chalk	12
Middlesex.—Almost entirely obtained by Metropolitan Water Board, and is apportioned between chalk (over 6½ millions) and gravel beds fringing the Thames (over 4¾ millions)	11¼
Cheshire.—Including 9 millions from bunter and ¾ million from keuper	10¼
Lincolnshire.—Including 4¼ millions from chalk and 1½ millions from Lincolnshire limestone	6½
Derbyshire.—Including 2½ millions from alluvial deposits lining the valley of the Derwent and 2¼ millions from millstone grit	5½
County of London.—The Metropolitan Water Board derive supplies from chalk exceeding 5½ millions	5½
Dorsetshire.—Including 3 millions from chalk and 1 million from gravel beds in the valley of the Stour	5¼
Somersetshire.—Including 2 millions from keuper and 1¾ millions from carboniferous limestone	4¼
Berkshire.—Including 3 millions from chalk	3½
Bedfordshire.—Including 1¾ millions from chalk and 1 million from great oolite ...	3¼
Warwickshire.—Including 2 millions from sandstones of coal measures	3¼
Suffolk.—Including 3 millions from chalk, and the remainder from crag	3¼
Wiltshire.—Including 2¼ millions from chalk	3
Worcestershire.—Wholly represented by bunter	2¼
Buckinghamshire.—Including 1½ millions from chalk	2¼
Gloucestershire.—Derived mainly from millstone grit, bunter, old red sandstone and inferior oolite...	2¼
Northamptonshire.—Mainly derived from marlstone (middle lias), Lincolnshire limestone, Northampton beds, and river gravels	2¼
Norfolk.—Obtains over a million from chalk and the remainder from lower greensand	1½
Cambridgeshire.—Derives 1 million from chalk and the rest from lower greensand ...	1¼
Oxfordshire.—Obtains the bulk of its supply from gravel beds bordering the Thames, and from chalk	1
Cornwall.—From granite and palæozoic strata, including water from mine sinkings	1
Glamorganshire ... Shropshire ... Devonshire ... Northumberland Leicestershire Monmouthshire ...	Small underground supplies from ½ million to 1 million each 4½
Herefordshire ... Denbighshire ... Huntingdonshire .. Flintshire ... Rutlandshire Pembrokeshire Merionethshire Cumberland ...	Less than ½ million each 1½
Anglesey Brecknockshire ... Cardiganshire ... Carmarthenshire ... Carnarvonshire ... Montgomeryshire ... Radnorshire ... Westmorland ...	No underground supplies ... ... —
Total	285

Sufficiency of Sources. As a guide to the sufficiency of sources, an attempt was made to ascertain the average daily quantity of water derived from each source and the further quantity available, and this information is given in the return in respect of most of the principal undertakings. Some cases, however, only permit of the average daily quantity of water

quantity been given, while in others the quantity of water available in excess of that taken is not known. Many of the smaller undertakers have no information as to the yield of their sources. It is impossible, therefore, to summarise accurately either the total quantity of water actually derived from existing sources or the total quantity available therefrom. But in the case of some undertakings vast quantities of water are said to be available in addition to the amounts actually used.

WORKS.

The particulars which have been given in the return under this heading relate to filtration, reservoirs for storage and distribution, and the sufficiency of the pressure. The works of all undertakers naturally include the means of collecting the water and of conveying it to consumers. The nature of the sources sufficiently indicates the nature of the works, such as intakes, borings, wells, pumping stations, which are required in each case, and it has not been thought necessary to include them.

Filtration.—Wherever possible, it has been ascertained whether the water is filtered, and, if so, whether the filtration is effected by means of ordinary sand filters or by mechanical, pressure or patent filters. The rate of filtration through sand (in gallons per square yard per day) has been mentioned where known. It appears from the return that surface water is generally filtered, whereas underground water, including that from springs, is not. Some important supplies from lakes, rivers, and mountain streams, however, are not filtered—*e.g.*, the Manchester supply from Lake Thirlmere, the Whitehaven supply from Ennerdale Lake, and the supplies to Blackburn, Oldham, Plymouth, Preston and Swansea from rivers and moorland gathering grounds. The return shows that 200 local authorities, 14 joint authorities, 89 companies and 116 private proprietors filter their water.

Reservoirs.—The primary use of reservoirs is to store water, but while some are used solely for this purpose, others, known as service reservoirs, are utilised also for equalising pressure, and others, known as compensation reservoirs, for ensuring the proper flow of rivers and streams. The name or situation and the capacity of every reservoir has been stated whenever possible, but those known to be used solely for purposes of compensation have been omitted. Storage have been distinguished from service reservoirs, but as a reservoir is often used for both purposes it is doubtful whether many of them have been rightly described by the undertakers. It has also been noted whether reservoirs are on a high or low level, and whether they are merely tanks or water towers. The return shows that only 34 local authorities, 2 joint authorities, and 7 companies do not possess reservoirs. The small capacity of some of the reservoirs belonging to the less important undertakings indicates that they are little more than cisterns.

Pressure.—Local authorities maintaining waterworks under the Public Health Act, 1875, have, under sec. 55 of that Act, a discretion as to whether the water they supply shall be constantly laid on at such pressure as to reach the top storey of the highest houses in the district supplied. The Waterworks Clauses Act, 1847, by sec. 35, lays this down as an obligation on all undertakers with special Acts which incorporate this section of the Waterworks Clauses Act, unless the special Act provides that the water need not be constantly laid on under pressure. This requirement is frequently modified in special Acts and Orders, which generally provide that water need not be delivered at a pressure greater than that afforded by gravitation from the service tank or reservoir from which the water is supplied. According to the return only 47 local authorities, 1 joint authority, and 5 companies furnish supplies with insufficient pressure.

Quantity of Water supplied.—The average daily quantity of water supplied, both directly to consumers and in bulk to other water undertakings, has generally been given. In some cases the undertakers have professed themselves unable to give the quantity supplied, and their statement as to the adequacy or otherwise of their supply has been accepted.

In several cases the quantity of water stated in the return to be obtained or to be available considerably exceeds the quantity delivered. Where the excess is in respect of water actually obtained, it would appear from inquiries made in some typical cases that a great deal more water is taken by the works than is necessary for the supply, and that the excess goes over the overflow into a stream. Where there is an excess of water available, it means that the quantity of water taken is not separated from the quantity that could be obtained, and the excess over the amount distributed may be regarded as the extra quantity that could be obtained by means of the works.

A comparison of the actual number of gallons of water supplied per day with the population or number of houses will often enable a calculation to be made of the number of gallons per head of the population per day supplied from a particular undertaking. It has not been thought worth while to set out the results of such calculations for the purpose of indicating the sufficiency or otherwise of the supply, since it is impossible to express a standard of sufficiency in gallons per head per day without knowing what is required in each case for trade and public purposes, whether efficient measures are taken to prevent waste, &c. The returns which have been obtained on this subject show the great diversity that exists in different districts in the number of gallons of water per day distributed by an undertaking. In the area of the metropolitan supply, according to the last report of the Metropolitan Water Board relating to the year 1913-14, just over 36 gallons per head per day is distributed. In a Parliamentary Return of 1882 relating to water supplies of five large towns, it appeared that Liverpool then distributed only 4½ gallons per head per day, while Bradford distributed 25 gallons, and had an estimated waste of 15 to 20 per cent. A similar return of 1888 showed a variation in the amount of water distributed from 8 gallons per head per day in Oldham and 12 gallons in Leicester and Nottingham to approximately 24 gallons per head per day in Kingston-upon-Hull and in the area of the Newcastle and Gateshead Water Company, 25 in Preston, 27½ in Swansea, 28 (including public purposes) in Dublin, 33 in Glasgow, and 35 in Edinburgh. Most of the authorities said the amount of waste per head per day could not be ascertained, but Belfast, Dublin, and Leeds Town Councils put theirs at over 1,000,000 gallons per day, and Glasgow at 15 gallons per head per day.

Constancy of Supply.—A better test of the sufficiency of a supply is its constancy, and the great majority of undertakers state that their supply is constant. Only 25 local authorities and 4 companies return their supplies as intermittent, but in a number of small undertakings it is admitted that the supply is inadequate, and in these cases no doubt there is not a constant supply. Sec. 35 of the Waterworks Clauses Act, 1847, requires water to be constantly laid on at such a pressure as will make the water reach the top storey of the highest houses within the limits, unless the special Act exempts the undertakers from this obligation, which it often does, but this provision is not incorporated with the Public Health Act, 1875.

QUALITY OF WATER.

Chemical and Bacteriological Examinations.—The freedom of a water supply from danger of pollution, and from the consequent risk of producing disease, can only be determined by close topographical examination of its sources. Its actual quality can best be judged by the results of chemical and bacteriological examination, and in every case in which the water was subjected to such examination the board endeavoured to obtain a copy of the latest analysis made. A brief summary of the results of these analyses has been inserted in the return to illustrate the quality of the water; the copies of analyses have been retained by the board among their records. In some cases in which the water is only occasionally examined the last analysis is too old to be of value. In other cases the details of the analysis were given without any comment by the analyst on the quality of the water, and in the absence of information as to the circumstances in which the sample analysed was taken it has been considered inadvisable to insert in the return an opinion on the figures of the analysis. From the return it appears that the quality of the water supplied, in some cases from one particular source among several, by 26 local authorities and 2 joint authorities is not satisfactory, while that supplied by 5 other local authorities is liable to pollution.

Quality of Water from Upland Surfaces.—The purity of water derived from these sources depends upon the freedom of the gathering grounds from contamination from human habitations, farm buildings and live stock. The Committee on British Forestry, which reported in 1902, drew the attention of local authorities deriving their water supplies from gathering grounds owned by them to the advantages and profits

to be derived from planting the catchment areas with trees, not only to contribute to the retention of the rain and assist in regulating the water supply, but to help to purify the water, and at the same time to yield a regular income on the capital expended. In connection with this report the Local Government Board obtained a return in 1903 showing which of the local authorities owning waterworks had acquired the freehold or long leasehold of the catchment areas from which their water supplies were derived. This return, which was not published, showed that at that time 5 joint boards and 74 town and district councils owned or had a long lease of a part or all of their gathering grounds.

Where adequate steps are taken to free the gathering grounds from risk of pollution, the water from these sources is, as a rule, exceptionally pure. But where, as often, the gathering ground is of a peaty nature there is a risk that the peat may discolour the water and render it turbid, and though this may not detract from its quality it is apt to create a prejudice against it. A great part of the supply to Rhondda urban district was at one time very discoloured from this cause, and the inhabitants resorted to neighbouring springs and rivulets, which were exposed to contamination, for their supply, with the result that outbreaks of typhoid fever occurred. The commissioners of 1866 rejected Mr. Bateman's plan for bringing water to London from Wales partly because they thought that coloured water would be unacceptable to the inhabitants of London. Such water requires to be filtered, with or without previous treatment by a chemical which will precipitate the colouring matter.

ACTION ON LEAD.

The chief danger of moorland waters is the tendency to dissolve lead which has been found to exist in waters derived from a soil containing peat, which usually have an acid reaction. The soft peaty water of the moors of Yorkshire and Lancashire are particularly acid. Such waters have in many cases caused serious attacks of lead poisoning among consumers of the water when delivered without treatment through lead pipes. The capacity of drinking waters to dissolve lead and to cause lead poisoning has frequently been investigated by the board. In his report for the year 1890 the medical officer to the board estimated that upwards of 600,000 persons in the West Riding of Yorkshire alone appeared to be, at one time or another, liable to lead poisoning by the drinking of water supplied in their districts. The latest special reports on the subject are those of Dr. Houston, published in 1903. In 1909 the board obtained detailed information from local authorities in whose districts water from moorland sources was supplied as to the action of the water on lead and the steps taken to counteract such action, with particulars of any cases of lead poisoning which had occurred in their districts as a result of drinking water from such sources. The results of this inquiry, which were published as an appendix to the annual report of the board's medical officer for 1908-9, showed that most of the undertakers supplying water from moorland sources took steps to treat the water with lime or whiting to counteract the tendency to dissolve lead, while in some instances lead service pipes were prohibited. These results are confirmed by the present return, which shows that nearly all of the undertakers whose water acts on lead require galvanised iron pipes or treat the water with soda, whiting, lime, or chalk. In several recent local Acts which authorise the abstraction of water from moorland gathering grounds, Parliament has required the insertion of a provision compelling the undertakers to treat the water so as to prevent its acting on lead before distributing it. In modern schemes of water supply from moorland sources the precaution has been taken of removing all beds of peat within the area of the reservoir; 1,000,000 cub. yds. of peat have been removed from the area to be covered by the Alwyn reservoir of the Birkenhead Corporation, and 100,000 cub. yds. from the Delph reservoir of the Bolton Corporation.

The fact that a water supply is derived from a peaty subsoil does not, however, necessarily make it plumbo-solvent at all times. Whitehaven Town Council obtain their water supply from Ennerdale Lake, and although the catchment area of the lake is covered with peat, it was found in the course of an investigation of an outbreak of enteric fever in Whitehaven in 1902 that water from the lake showed no plumbo-solvent tendency at that time. Consequently Penrith Urban District Council, who derive their water supply from Haweswater, a lake 24 miles due east of Ennerdale Lake with a similar catchment area, gave up treating their water with lime, and no action on lead has apparently since been observed in this water.

Hardness.—The total and permanent hardness of the water is given in each case in which it could be ascertained in degrees, according to Clark's scale. In some cases, where the water is very hard, a softening process is adopted, but it will be seen that many of the waters supplied are of a high degree of permanent hardness.

PART II.

Part II. of the return shows how every district and parish in England and Wales is supplied with water. The districts are arranged in counties, and the Welsh counties, including Monmouthshire, appear together after the English counties. County boroughs have been included in the geographical county within which they are deemed to be situated, and with the other urban districts in the county are arranged in alphabetical order, and these are followed by the rural districts with their respective parishes, also in alphabetical order. The districts are given as they existed at April, 1914. They comprise London, 80 county boroughs, 244 other boroughs, 806 urban districts, and 650 rural districts with 12,869 parishes.

As previously stated, a piped service is provided within 1,101 of the total 1,130 boroughs and urban districts, and in 4,874 of the 12,869 parishes in rural districts throughout England and Wales, and only 29 boroughs or urban districts are at present without any piped supply; 67 urban areas, however, have no piped service to more than 50 per cent, and 320 to more than 5 per cent of the houses in the district. Approximately 62 per cent of the rural parishes are without piped supplies. For the purpose of the return it has been found necessary to ignore supplies brought from a distance in pipes to single country houses, though where such a supply is made available for 10 houses or more it has been included as an "undertaking."

A general statement of the sources, quality and adequacy of supplies where there is no piped service has been given in respect of each district and parish. Since many parishes depend on more than one source, and the quantity and quality of the supply from each source necessarily vary considerably, any general summary of the nature, quality and quantity of the unpiped supplies in a particular parish must be to a large extent misleading. Moreover, in a great many rural parishes no systematic action has been taken to ascertain the quality of the various unpiped sources of supply. Many of the wells in use would, no doubt, be found, on examination, to be liable to pollution and unsafe for drinking; but where they have been used for years without untoward results they are generally regarded by the inhabitants and the council as pure and sufficient. The chief sources of unpiped supplies are wells, which have been variously described as "artesian," "bored," "tube," "deep," "dip," "draw," "surface," "shallow," "very shallow," "public," "private," "pump," or simply as "wells." These descriptions have been omitted in the return, as it is not clear that they are used in the same sense in different parts of the country. This is especially the case with regard to "deep" and "shallow" wells. In order to distinguish between deep and shallow wells the Rivers Pollution Commission, in their report on domestic water supplies in 1874, classified all wells less than 50 ft. as shallow, but the character of the stratum from which the water is derived is often more important than depth in feet when determining whether a well should be described as deep or shallow. Wells, no doubt, provide most of the unpiped supplies of the country, and most of them are shallow in the sense that their water is derived from the subsoil which is frequently liable to pollution from privies, leaking sewers, cesspools, drains, refuse heaps, and other sources of contamination in their neighbourhood. Many epidemics in rural districts have been traced to water derived from such wells.

Many villages possess public wells, which are generally fitted with pumps. These supplies, which have existed in some cases from time immemorial, were vested in the local authority by sec. 64 of the Public Health Act, 1875. Springs are largely utilised as sources, and the supplies obtained from them are generally described as adequate and of good quality.

Supplies are in some places obtained direct from rivers, streams, canals, lakes, ponds and gathering grounds. Streams are variously described as "becks,"

"brooks," "burns," "mill races," and "rivulets," and lakes as "meres," while other unpiped supplies are returned as derived from "moorlands," "uplands," "ditches," "dykes," "field drains," "land drains," "reens," "rhynes," "spouts," "surface pits," and "ponds." All these sources are often liable to pollution, and as the water so obtained used without filtration the supplies must be regarded as generally indifferent.

Rain water is the sole means of supply in some places, while in others it contributes largely to supplies where there is no piped service. The quality and sufficiency of this supply depend mainly upon the methods of collection and storage. In a few instances water is obtained from colliery workings and mines, and in one case from water-cress beds fed by artesian wells. The only supply to four houses in the parish of Tankersley, in Wortley Rural District, consists of condensed steam, which is said to [illegible] satisfactory.

ROAD SURVEYORS' ASSOCIATION OF SCOTLAND.

ANNUAL MEETING.

The thirtieth annual general meeting of the Road Surveyors' Association of Scotland took place at Aberdeen on Friday last, Mr. James Watson, Strathaven, presiding.

In the course of the proceedings Mr. Peter Clarke (Dunbar) was elected president, and Messrs. A. Forbes (Dunfermline) and W. L. Gibson (Dunblane) were elected vice-presidents. The hon. secretary and treasurer, Mr. Allan Stevenson (Ayr), was reappointed. The members of committee were chosen as follows: Messrs. George Donaldson (Kirkcaldy), J. M. M'Gregor (Maybole), P. M'Farlan Cram (Nairn), Robert Robertson (Inverness), Donald R. Cox (Stirling), George Calvert (Haddington), W. A. Chapman (Airdrie), W. Ellacott (Bonnyrigg, Midlothian), R. Paterson (Lockerbie), D. Robb (Wigtown), W. Hendry (Bridge of Weir), and Kenneth M'Crae (Oban).

Mr. P. Clarke then took the chair, and a series of discussions followed as to the possibility of securing uniformity in the system of keeping road accounts, the economics of road surfacing, and the best way of obviating the difficulties frequently met with in the filling up of opened road tracks.

Mr. R. Drummond, who represented the Road Surveyors' Association of Scotland, and the Institution of Municipal and County Engineers at the Departmental Committee inquiry held in London on the question of the damage caused to roads by heavy motor vehicles, indicated the lines upon which he had given evidence before this body. With Mr. Drummond's able representation of their case the members expressed their satisfaction.

It was agreed that the next meeting of the association should be held at Glasgow in August, 1916.

On Saturday the members of the association and a party of friends proceeded on a motor drive to Banchory, by way of the Duthie Park and the Rubislaw Quarries, and along the north and south sides of the river Dee.

Main Road Maintenance in Somerset.—The Streets and Highways Committee of Taunton Town Council recently presented a report submitted by the borough surveyor, Mr. D. Edwards, with reference to the main roads in the borough, which contained the following: "During the past six weeks I have had a survey made of the whole of the main roads—5½ miles—within the borough, and calculation of the areas completed, including roads and pavements. These are classified under the various materials of which the roads and pavements are made, and they give interesting data as to the cost of maintenance. Last year the cost of maintenance per mile was £349, which is practically the same as in 1906-7, and less than any other year, excepting 1908-9, when it was £318. In giving the cost of maintenance per mile, and comparing with the costs of other towns, the figures do not give a true comparison, as the roads vary in width and various other circumstances exist which prevent a true comparison being made. I have consequently worked out the cost of the maintenance per unit area, and it amounts to 6d. per super. yard of road surface, and 1·13d. per super. yard for pavements. This is comparatively small, and I doubt if other towns in Somerset can show such a small figure." This statement was accompanied by tabulated details, a copy of which had been sent to the county surveyor at his request.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not to be hoped that the cause of the failure of the reinforced concrete tubes at Epsom will be thoroughly investigated, and the reasons for the failure communicated either to the Institution of Municipal and County Engineers or to the Concrete Institute? Has it not often been truthfully stated that we learn as much, or even more, from failures than from successes? Was the cause of failure due to local circumstances, undue internal or external pressure, faulty construction, faulty laying, or ground movements?

* * * *

Is it a fact, as stated by Mr. Thropp, the county surveyor of Lindsey, that he is able to lay tar-macadam on his roads at the very low cost of 1s. 4½d. per square yard? As this would bring this material within the same cost as ordinary water-bound macadamised roads, would it not cause a revolution in road construction?

* * * *

Is not the recently issued Blue-book on the Water Undertakings of England and Wales full of most useful information to all water engineers, whether domiciled in this country or abroad? Should not the compilers of this record be heartily congratulated on their efforts, which have resulted in the production of a report which should serve as a model to all future Government reports?

* * * *

Is there not a great deal of truth in the remarks which were reported to have been made at a recent meeting of the Basford (Notts) Rural District Council as to the waste that is going on in nearly all Government Departments? Is it not a fact that there are constantly being sent broadcast by many of the Government Departments thousands of tons of literature which serves no very useful purpose during the present critical time, and could not the energies of the able-bodied men who are engaged in flooding the country with this literature be more usefully employed elsewhere?

* * * *

Why should the writer in the *Times*, a short time ago, on "Municipal Waste in London," be exercised in his mind as to the differences of the cost in highway maintenance, giving as instances Islington at £475 per mile per annum, St. Pancras £946, and Marylebone £1,213? Would not a little reflection have shown him that the difference is entirely due to traffic, and that, of course, the upkeep of the roads in Marylebone must cost a great deal more than those of Islington? When will laymen cease to write about things of which they have only a partial knowledge?

* * * *

Cannot the Cheam Parish Council devise some better means of calling their fire brigade together than that of exploding bombs or maroons? Can one wonder that, according to a recent issue of the *Surrey Comet*, there were some expostulations from members of the parish council as to this practice needlessly alarming the inhabitants at the present time?

* * * *

Is there anything very wonderful in the report as to the diminution effected in the waste of water at Washington, U.S.A., over a period of seven or eight years? Is it not a fact that there are a large number of towns in this country where an extraordinary diminution of waste of water has occurred on the introduction of a thorough system of the well-known Deacon's waste-water meters, by means of which, with a modicum of labour and cost, the waste of water has often been reduced 50 per cent in two or three years?

* * * *

What useful information for road engineers can be gained by a perusal of the Fifth Annual Report of the Road Board is one of the things one would like to know. Does it not bristle with figures which may be useful to the Treasury, but otherwise convey very little of practical interest? Could not a useful table have been prepared out of Appendices 2 and 3, showing the amount of grants and loans which the board had made for tar-painting, grouting, tar-slag, tar-macadam, bituminous carpeting, water-bound macadam, wood blocks, stone setts, and so forth? And would not such a statement have been a guide to road engineers as to what is at present the most popular method of road surface treatment?

OXFORDSHIRE COUNTY ROADS.

THE RECONSTRUCTION AND IMPROVEMENT SCHEME.

The county surveyor of Oxfordshire, Mr. S. Stallard, in the course of his annual report, stated that the length of the main roads in the county is 481·7 miles, and in the past year they were maintained as follows. Urban main roads by district councils, 30·64 miles; rural main roads by county council, 438·64 miles; urban main roads by county council, 12·42 miles. Mr. Stallard proceeds: The beginning of the year 1914-15 marked the commencement of work under the Road Board scheme for the reconstruction and improvement of the important trunk roads of the county. The total cost of the work is estimated at £125,000, spread over a period of nine years. It was intended that the greater part of the work should be done in the first three years of the scheme. The expenditure contemplated in the first year was £45,087. A good start was made in the Central, Culham, Thame, Witney East, and Woodstock divisions, but the great shadow which fell upon Europe in August last soon made its effects felt in various ways in the work of road maintenance. Difficulties quickly arose in the transit by railway of the required material, and other causes led to a curtailment of the contemplated work. Moreover, an intimation was received from the Road Board that only such reconstruction should be proceeded with as could not well be postponed, and that in the meantime temporary measures should be resorted to wherever possible. The actual expenditure of the year under the scheme amounted to £28,287. The use of bituminous material has already resulted in a great improvement of those sections of the main roads which have been so treated, and this despite the demand made on the road surfaces by the ever-increasing self-propelled traffic. There is a noticeable increase in the use of motor tractors and trollies usually drawing a wagon; these are registered under the Motor Car Acts, and thus escape the licence duties and fees which are payable by locomotives licensed under the Locomotives Act. This mode of haulage will doubtless continue to increase, and it is satisfactory to know that consideration is being given to it with a view to the better regulation of speed, weight of loads, width of tyres of wheels, licence duties, &c. In connection with the Road Board it should be mentioned that the question of making grants for tar-painting rural roads has been considered by them, and it is understood that, when circumstances are more favourable, the board will be disposed to regard tar-painting as of value in preserving the surface of the road as well as mitigating the dust nuisance caused by motors.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

Good Work by Rawtenstall Motor Fire Engine.—Lancashire was well to the front in recognising the advantages of motor fire engines, and quite a large number of brigades in the County Palatine now possess these useful pieces of apparatus, several of which have proved their worth on numerous occasions. The latest achievement goes to the credit of the Rawtenstall engine, which is of the Merryweather petrol "Hatfield" type, and has been in service for the past two years. This engine recently attended a fire at Bacup, and as evidence of its work on this occasion we cannot do better than quote the words of Superintendent P. R. Webber, the chief officer of the Rawtenstall Brigade—viz.: "We were enabled to travel over 4 miles from our central fire station and had four jets working in fifteen minutes. The pumps were working at full pressure for six hours without a single stop. Such a result deserves every commendation, and speaks volumes for the efficiency of the 'Hatfield' pump."

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Limited. Price 10s. 6d.

KILLED IN ACTION.

Lance-Corporal W. Rickard Bailey, surveyor to the Holbeach Urban District Council, and son of Mr. J. Bailey, surveyor to the Spalding Urban District Council, was killed while engaged with others in wiring the front of a trench, being shot in the head. Captain Hart, under whom Lance-Corporal Bailey served, has written to the deceased's parents: "I, personally, have lost a friend and also a soldier in whom I placed the utmost confidence. He will be greatly missed in the company, and I trust you will bear up in your great bereavement, knowing full well your son died doing his duty for King and country." Lance-Corporal Bailey, who was in his twenty-eighth year, was about to receive his second promotion.

ROYAL SANITARY INSTITUTE.

PROVINCIAL SESSIONAL MEETING, BRIGHTON.

A sessional meeting will be held on Friday and Saturday, September 3rd and 4th, in the Permanent Art Gallery, Brighton, at 10.30 a.m., when discussions will take place on "Indian Sanitation," "Camp Sanitation," and "The Final Report of the Royal Commission on Sewage Disposal."

The chair will be taken each day at 10.30 a.m. by Sir Henry Tanner, C.B., I.S.O., F.R.I.B.A. (chairman of the council of the institute). Vice-chairmen: H. Percy Boulnois, M.INST.C.E., Louis C. Parkes, M.D., D.P.H., Colonel J. Lane Notter, M.A., M.D., R.A.M.C.

Tickets for admission of visitors may be had on application to Dr. Duncan Forbes, medical officer of health, Town Hall, Brighton, who is kindly acting as the local hon. secretary of the meeting; and of E. White Wallis, secretary.

PROGRAMME.

Friday, September 3rd.

10.15 a.m.—His Worship the Mayor (Alderman J. L. Otter, J.P.) will welcome the members of the institute to Brighton.

10.30 a.m.—Discussion on "Indian Sanitation."

1—"Sanitary Problems in Hospitals for Indian Troops in England," by Major S. P. James, M.D., I.M.S., the Kitchener Hospital, Brighton.

2—"The Use of Storm-water Drains to Ensure Safe Water Supplies being Obtained from Polluted Catchment Areas," by Major C. C. Murison, I.M.S., staff officer, the Kitchener Hospital.

12 noon.—Discussion on "Camp Sanitation" to be opened by Lieut.-Colonel H. R. Kenwood, M.B., R.A.M.C.

2.30 p.m.—Visit to the Kitchener Indian Hospital. The party will assemble at the North Gate of the Royal Pavilion, close to the library, and will proceed by car.

3 p.m.—Visit to the Royal Pavilion Indian Hospital. The party will assemble at the North Gate of the Royal Pavilion, close to the library.

8.30 p.m.—Reception by his Worship the Mayor at the Permanent Art Gallery.

Saturday, September 4th.

12 noon.—Discussion on "The Final Report of the Royal Commission on Sewage Disposal" to be opened by Samuel Rideal, D.SC., F.I.C., and J. D. Watson, M.INST.C.E. (engineer to the Birmingham, Tame and Rea District Drainage Board).

2.30 p.m.—Visits will be made to Shoreham Camp and the Brighton electricity works.

STUDENTS' LECTURES.

The fifty-ninth course of lectures and demonstrations for sanitary officers will commence on Monday, September 20th.

Automatic Street Lighting at Barrhead.—The Barrhead Town Council have installed the Alder and Mackay automatic system of street lighting. The installation was tested last week for the first time, and was completely successful, all the street lamps being lit within a few seconds. The four-wave method has been adopted, this permitting of a proportion of the lamps being extinguished about midnight and relit early in the morning.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. SEPTEMBER 3, 1915. No. 1,233.

Minutes of Proceedings.

Sewage Disposal by Aëration.

Particulars of the work which is being done in carrying out experiments in the latest method of sewage treatment are gradually coming to hand. A short time ago we had the paper by Mr. Wakeford on the Wakefield experiments, and in our issue of August 20th we printed a report upon the experiments started by Mr. R. O. Wynne-Roberts at Regina, Canada. This week we print a detailed report, for which we are indebted to our esteemed contemporary *Engineering News*, by Mr. T. Chalkley Hatton, chief engineer to the Sewerage Commission of Milwaukee, upon the experiments which are being carried out in that city. In all cases the results are, as yet, inconclusive in several respects, although they confirm the efficiency of the process generally. The most difficult questions to be settled are the best method of air diffusion, and the adaptation of the process to the continuous method of operation. We notice that Mr. Wynne-Roberts in one experiment introduced the air by injection into the delivery pipe, so that it was carried through by the sewage into the tank. Although this method has obvious disadvantages, it should be given a thorough trial before the idea is abandoned. At the same time it is very necessary to have a clear conception of what is involved in the process. So far as we can see, it is a method of cultivating enormous numbers of nitrifying organisms in the sludge at the bottom of the tank, and then very thoroughly mixing this sludge with the sewage, so that the nitrifying organisms may deal with the organic matter in solution. The compressed air serves two purposes—first, in supplying the oxygen required in the cultivation of the nitrifying organisms, and secondly in agitating and stirring up the sludge so that it becomes thoroughly mixed with the sewage.

For the first part of this operation it is obvious that the air must be delivered among the sludge at the bottom of the tank in as small bubbles as possible, and in such a manner as to spread over the whole area of the tank. The methods adopted at Milwaukee appear to fulfil these conditions, although we are not in a position to judge whether the limit has been reached in the breaking up of the air into minute bubbles. The discharge of the air in large bubbles would probably be more effective in stirring up the sludge, but it would also be less efficient in activating the sludge, and involve the use of an unnecessarily large volume of air. On the other hand, the mixing of the sludge with the sewage must proceed from the bottom upwards, and will naturally be less thorough at the top water-level of the sewage. The tanks at Milwaukee are 10 ft. deep, and it would be interesting to learn to what degree the sludge is mixed with the sewage at various depths, and particularly in the first foot or two from the top. There would seem to be two ways of securing the most intimate mixing of the sludge with the sewage, and we are not aware that either of these have so far been given thorough trial. One of these is the use of comparatively shallow tanks, so that the agitation by the air of the sludge shall be of sufficient force to carry it up through the full depth of the sewage. It might be argued that in such a case the air would escape too rapidly to have had its full effect in activating the sludge, and that deeper tanks are necessary to provide the time required for the air to give up the maximum amount of oxygen to be obtained from it. In this connection it would be desirable to have definite records of the time taken by the air bubbles to rise through varying depths of sewage.

The other method is to provide transverse baffle walls which would cause the sewage to flow alternately over and under these walls, and thus bring it downwards under every second towards the bottom, where the sludge is greatest in quantity. This could be tried both in shallow and in deep tanks, and it is probable that the best results would be obtained if the sewage were made to travel across the greatest width of the tanks. Further, if the tops of the baffle walls were carefully arranged to form weirs the full width of the tanks, and the openings at the bottom of the intermediate walls were also carried the full length of each wall, the sewage would then travel in the form of a thin film through the whole tank both horizontally and vertically, and the maximum degree of mixing would be obtained. The amount of air used in the Milwaukee experiments seems enormous, and may be still higher in the experiments on the continuous system which are now being carried out, and it is clear that it is in the direction of reducing the quantity of air required that efforts should be made by those who are conducting experiments at present.

* * *

Contracts and the War.

There can be few, if any, local authorities that have not been approached by contractors desirous of altering the terms of their contracts in view of the changed conditions brought about by the war. While probably in most cases such

applications are perfectly genuine, in not a few instances the war has been made an excuse for attempting to obtain more favourable terms merely with a view to increased profit. A particularly hard case appears to have arisen at Axbridge (Somerset) in the case of the contract for quarrying, breaking, hauling, and yarding up stone for the district roads. It seems from a letter written to the Local Government Board on behalf of the contractor, which was read at the last meeting of the rural district council, that it is impossible for the contract to be fulfilled in consequence of the shortage of labour caused mainly by the high rate of wages being paid for Government work in the immediate neighbourhood. This letter was addressed to the board in consequence of the attitude adopted by the council, who took the view that, although they regretted the position in which the contractor found himself, they were unable to vary or in any way interfere with the contract. The reply of the board was to the effect that in similar cases they had stated generally that where a contract has been entered into with local authorities, and, owing to unforeseen conditions attributable to the war, the contractor is unable to supply goods, and so forth, at the contract prices, the board are not prepared to say that the local authority, instead of enforcing their legal rights, may not arrange with the contractor to continue to supply on the understanding that, while the contract will form the basis for arrangement as to the prices to be paid, the actual amount will be settled at a subsequent date either by agreement or by arbitration. It will be for the local authority in the particular case to consider whether the circumstances affecting the contract would justify such a course, and any increased payment they might make to the contractor would have to come before the district auditor at the audit of the accounts of the local authority for consideration as to its reasonableness. The advice given by the board certainly does not err on the side of certainty. If, in the present state of the law, it is impossible to give more definite counsel to local authorities, it would seem to be eminently desirable, in view of the very large number of cases that have arisen, that the matter should be dealt with by legislation.

* * *

War-time Economies.

For months we have been urging in these columns the necessity for economy in municipal expenditure in view of the financial situation created by the war. At the same time, in view of the absurd, though doubtless well-intentioned, suggestions that have been made in uninformed quarters as to the directions in which such economy may best be practised, we have uttered repeated warnings against those forms of saving which would prejudice the public health and other vital services. In the present issue the whole subject of municipal economy is discussed in a most suggestive article by Mr. W. H. Maxwell, the borough surveyor of Tunbridge Wells. It must by this time be patent to all that some forms of economy are essential by reason of the unprecedentedly heavy demands made by the Government on the resources of the country both in men and money; so that the real problem is one of selection—that is to say, where to begin. Our view has always been that the municipality should answer this question in the same way as the individual—namely, by determining to eliminate all expenditure on luxuries, but not to economise on necessaries at the expense of efficiency.

Mr. Maxwell agrees with this view, and endeavours to classify the usual municipal services into what he calls "luxuries" and "prosaic necessities." The great thing to be avoided is the curtailment of the efficiency of any of those services which directly affect the public health. This does not mean that no economies can be effected in this direction. On the contrary, a careful survey of existing conditions would, in most towns, lead to the avoidance of some wasteful expenditure, while the co-operation of the public would lead to a considerable reduction in some departments, such as that of refuse collection and disposal. In regard to highways, a subject upon which many voices have made themselves heard, Mr. Maxwell wisely sums up the position in the very true distinction which he draws between real economy and merely "deferred expenditure." The curtailment of expenditure in the maintenance and repair of highways, he says, can seldom be safely regarded as true economy, but is really only a deferred expenditure shelved at compound interest for succeeding years. It would be well if every highway authority thoroughly realised the truth of this statement.

* * *

Metropolitan Munitions Committee.

It will be of interest to the engineering world, and to manufacturers generally, to learn that the organisation of the Metropolitan Munitions Committee is now practically complete, and that most excellent work is being done. A central office has been established at Alexandra House, Kingsway, with Mr. Cecil Partridge as general manager, and Mr. Ireland as chief engineer, with a competent staff and commodious premises. The jurisdiction of the committee extends over the whole of the Metropolitan Police area, which has been divided into ten districts, each under a district manager, associated with an assistant and a munitions engineer, and the following gentlemen have been appointed as district managers:—

District.	*Name.*	*Address.*
Northern ...	A. Hugh Seabrook (acting)	62 Finsbury-pavement, E.C. (temporary address)
North-Western	E. T Ruthven Murray	346 High road, Kilburn, N.W.
Southern ...	A. C. Cramb	Town Hall, Croydon
South-Eastern	W. G. Head	Borough Hall, Royal-Hill, Greenwich, S.E.
South-Western	C. O. Grimshaw ...	6 Eccleston-place, S.W.
Eastern ...	C. Newton Russell ...	215 217 Bishopsgate, E.C.
East Central & part South-Eastern	E Harlow	64 Bankside, S.E.
Western ...	R. S. Downe ...	Carnegie Library, Hammersmith, W.
Poplar and Stepney	G. M. Gill (temporary address)	East London College, Mile-end, E.
Outer Eastern	S. H. Wood	Gas Works, Beckton

Any information likely to be of use in connection with the production of munitions, and all enquiries, offers of premises, of tools, plant or services, &c., should be directed to the General Manager, Metropolitan Munitions Committee, Alexandra House, Kingsway, or to one or other of the district managers, according to the district.

* * *

A Preesall Councillor's Obsession.

Some people, like Rip Van Winkle, indulge in a prolonged sleep, and, like him, awake to see that great changes have taken place in the interval. Others there are who metaphorically court the oblivion of Nature's sweet restorer when they have been elected to some public office such as that of a district councillor, and remain asleep until the ratepayers become sufficiently wide awake to their uselessness. In this latter category must surely be included a member of the Preesall Urban District

Council, which was still in a semi-comatose state, recently startled the council by asking how it was that months after it had they kept passing accounts without getting anything in return. He did not, it was just enough to say, blame the surveyor, or the men, but the council. Month after month, he proceeded, there appeared such items as the clerk's, surveyor's, and workmen's wages, and printing expenses, and they were running away with something like £30 a month without anything being done. Asked if he proposed to dispense with the services of some of the men, the sleepy one replied that he did not propose to dispense with the services of anybody. He wanted some work to be done for the improvement of the district—something to show to the ratepayers. Another councillor suggested that as the gentleman had attended committee meetings he ought to have brought forward his complaint there, to which the dissatisfied one retorted that he had asked the question in committee several times. It was not surprising in the circumstances that the council proceeded with their business, while doubtless the councillor relapsed into the condition of complete somnolence into which his councillorship has plunged him. If he could appreciate things out of the land of dreams he might perchance realise that if the council officials are unnecessary he himself must lag superfluous on the stage.

* * *

A Municipal Sin.

Without entering upon any discussion as to the proper functions of the pulpit, the denunciation in the course of a sermon on the action of a local authority in regard to sewage disposal is sufficiently remarkable to arrest attention. The trouble has arisen at Warwick, and the gist of the complaint is that, pending the completion of the new works at the outfall, the town council have allowed the whole of the crude sewage to go into the river Avon, which is alleged by the county medical officer of health to have become seriously polluted in consequence. The county council have resolved to submit a report of the whole matter with a view to their considering what steps can be taken to increase the powers of county councils to prevent the pollution of streams in this way. One clergyman described the action of the town council as unneighbourly and un-Christian, while the Vicar of Hampton Lucy, in the course of a sermon, stigmatised it as a municipal sin, and as being "quite contrary to the treatment we ought to receive from our neighbours in a professedly Christian country." In view of the public nature of these utterances, the chairman of the Sewage Farm Committee felt called upon to make some reply, and has stated that, owing to the war and to continuous wet weather, the council have had to face very serious difficulties in carrying out the scheme. Moreover, he asserts that the method adopted of dealing with the sewage was the same as that used in other towns under similar circumstances. No objections were made to the council's proposals at the Local Government Board inquiry, when the county medical officer seemed satisfied. The decision of the county council to submit the matter to the Local Government Board will no doubt ultimately open up an opportunity for the town council to represent their view of the case.

* * *

The Meaning of "Vitrified."

Few engineers would probably care to be asked to describe the precise significance of the term "vitrified" as applied to clay products, and the suggestion of Mr. Edward Orton, the dean of the College of Engineering of Ohio State University, for a legal definition is therefore of considerable interest. The proposed definition, which was contained in a paper which Mr. Orton read before the American Society for Testing Materials, is as follows:—

"Where the word 'vitrified' is used in a contract or agreement in describing the properties of a clay product, and is not further defined in the contract, it shall mean that the product shall have attained in the firing process such a degree of compactness that its mean absorption does not exceed 3 per cent of its own initial weight of pure water, when subjected to complete immersion in cold water for forty-eight hours, or boiling water for three hours. Not less than three tests shall be made in determining the mean absorption, and no single test may exceed the mean by more than 0·5 per cent. Neither the possession of the visual properties or appearance of a glass, nor any definite degree of physical strength, hardness, colour, or specific gravity shall be implied as an attribute of vitrification."

As a matter of drafting, it is perhaps difficult to see the necessity for the latter part of the definition, which is purely negative in character. Practically, however, the words may be regarded as not entirely superfluous, for hitherto colour, texture, hardness, strength, and specific gravity have all been regarded as tests rather than as mere attributes of vitrification. The important point is compactness, a quality which may be determined by the single and simple test of absorption.

* * *

An Appeal.

In our issue of July 30th last we drew the attention of our readers to the sad case of Mrs. Lilian Bradshaw, the widow of the late Mr. F. E. G. Bradshaw, formerly borough surveyor of Tamworth. We are now glad to be able to record that the generosity of a number of our readers has supplied a certain sum of money by which immediate needs have been met. A list of the donors will be found in another column, and, while thanking them for their kindly assistance, we would point out to those who may not have seen our former appeal that further donations, *however small*, are still needed. Moreover, in the letter which was originally sent to us by Mrs. Bradshaw, she asked for a home and school for her young son, three years of age, and stated that she herself would be willing to accept a post as housekeeper. Neither of these requests has as yet been granted, and we again ask any of our readers who may be able and willing to assist in either direction to communicate with us. We understand that the case is under consideration by the committee of the Orphan Fund of the Institution of Municipal and County Engineers, but, as is well known, the funds at their disposal are limited, and the claims upon them are many. We hope, therefore, that by the generosity of our readers we shall soon be enabled to publish a further list of donations.

A Matter of Chippings.—A resident in Batsford road, Deptford, wrote to the town clerk of that borough complaining that "several heaps of small pebbles" had been placed in the channellings, presumably for asphalting purposes, and that they had been distributed by the children all over the footpaths and roadway, causing great inconvenience to pedestrians and others. The borough surveyor, Mr. J. Sutcliffe—whose appointment as borough engineer of Woolwich was recently announced in these columns—has sent a reply in the following terms: "Dear Sir,—I have received your letter *re* the above, and I beg to point out the error in your conclusion. The great mistake that was made was the allowing of rain to fall on Sunday, Monday and Tuesday last. Had the authority in that matter not blundered so egregiously, the chippings deposited in the road would have been used almost as soon as they got there. I suggest also from the revelations of your letter that there is vast room for improvement in the control of the children of the district by parents and others. Neither of these matters, as you will probably understand, is within the purview or the jurisdiction of the borough council."

Municipal Economy.

By W. H. MAXWELL, Assoc.M.Inst.C.E., Borough Surveyor, Tunbridge Wells.

A new map of Europe, and of several other parts of the world, is now being worked out, and big historic events are being daily hammered into shape upon many a stubborn battlefield. Of no time in the past can it be more truly said that "history is in the making." For the records of "The Great War" which crashed in upon the Continent in August, 1914, to the surprise of all, except perhaps the Central European Powers, will assuredly stand out with a special prominence in the history of the world and of civilisation to the end of time.

No parallel can be found for this great conflict with which fully to gauge its present significance, and no experience is available whereby its future consequences and limits can be predicted. This is well exemplified by the rapid development of the struggle. From what first appeared to be little more than local political differences between Serbia and Austria a European war suddenly evolved, which is now rapidly assuming the broader issue of a world-struggle by civilised humanity against an attempt at world domination by means of bare brute force, aided by every form of man-killing device modern science can produce.

The equipment for this twentieth-century war thus involves not only the placing and maintaining in the field of large masses of able-bodied, trained men, but also the utilisation of an immense output of mechanical devices from engineering workshops and other manufacturing concerns requiring, in the aggregate, the diversion of huge sums of money from their accustomed channels.

"NOTHING AS USUAL."

To meet this unprecedented drain, economies in numerous directions become essential, whether they be personal, domestic, municipal, or national, and the doubtful doctrine of "business as usual" must perforce give place to one of "nothing as usual."

Economy necessarily involves some sacrifice, and one of the first steps towards securing it is to take on that attitude of mind which enables a community to be satisfied with something less than was formerly considered needful. Neither war nor economy can be successfully waged when everything is expected to be "as usual," and as soon as this fact is fully realised the door is at once opened for possible reductions of expenditure. To many departments of municipal activity with which the present article is specially concerned, this condition is particularly apposite.

Life in towns conduces to the development of certain more or less artificial wants, which, on investigation, are oftentimes found to be by no means indispensable, and their abolition at once reduces expenditure while practical needful efficiency remains unimpaired.

The requirements in different towns vary according to their situation and local conditions, so that no absolutely hard-and-fast dividing line applicable to all cases can be drawn to separate the "luxuries" from the prosaic "necessities"; but, generally speaking, optional matters, such as parks and pleasure grounds, public music and other forms of entertainment, museums, and excessive street lighting afford ample scope for legitimate retrenchment without throwing any additional burden of expenditure upon succeeding years.

In the category of prosaic necessities may be included matters affecting the public health, sewerage, cleansing or scavenging of streets, house-refuse collection and disposal, public baths, water supply, and such like.

Careful discrimination should be made between cases of mere deferred expenditure and those which can be dispensed with altogether as being not essential. The postponement of absolutely necessary expenditure is not "economy," but frequently the reverse, and any indulgence therein will invariably build up a burden for succeeding years, with compound interest.

Throughout the country much municipal labour has been transferred for purposes of Government work, and also to augment H.M. Forces, and, in some cases, where suitable arrangements can be made, vacancies so caused need not be refilled during the temporary absence of employees, thus affording opportunities for economy.

In public parks, pleasure grounds, promenades and such like considerable economies are possible by the temporary sacrifice of nothing more serious than some degree of their customary stereotyped neatness and the discontinuance of the costly flowering of formal "beds" with the many accessory expenses necessarily involved.

Public music, and all other forms of entertainment are out of harmony with the spirit of the times, when the soul of the nation is, or ought to be, concentrated upon business having for its object the furtherance of military and naval effort in every possible degree.

Another source of heavy expenditure is that of street lighting by means of powerful units of light, which enable the plan of a town and its principal buildings to be readily followed and located from above, thus providing convenient targets for hostile aircraft. Brilliant street illumination in war time cannot be looked upon as being either necessary or even desirable, while its discontinuance, if only in part, affords considerable scope for retrenchment. The saving under this head is one which can be made with the minimum of public inconvenience and without involving any question of deferred expenditure with which to burden succeeding years.

PUBLIC HEALTH.

In all matters of public health but little opportunity arises for curtailment of expenditure, except in cases where some item of wasteful or excessive expenditure is known to exist. Beyond this any material reduction is likely to prove to be false and expensive "economy," especially at a time like the present, when considerable numbers of soldiers are billeted in towns, and the maintenance of a high standard of public health is therefore of more than ordinary importance, both from a national as well as a local point of view.

There is probably no department of municipal expenditure in which the general public can assist the authorities more than in that of street cleansing or scavenging, inasmuch as the bulk of the refuse and litter to be removed arises from the very general practice of casting off of promiscuous rubbish into the public thoroughfares, including, for example, such litter as shop-sweepings, paper, loose outer packings dropped by tradesmen's delivery boys, banana skins, orange peel, handbills, torn correspondence, and other innumerable rubbish commonly, but illegally, thrown into the roadways.

Nothing perhaps more quickly gives a town a shabby, neglected appearance than streets besprinkled with such litter, but its daily collection and removal entails much avoidable expense in labour and cartage if the standard of cleanliness is to be maintained much above that of an Oriental city.

A statutory provision against the deposit of rubbish in streets has long existed, and its more general application would certainly afford an important source of economy. The enactment should be more widely made known.

The curtailment of expenditure in the maintenance and repair of highways can seldom be safely regarded as true economy, but is really only a deferred expenditure shelved at compound interest, for succeeding years. If needful repairs are too long postponed, in many cases the foundations of the roadways become weakened and so badly cut into and waterlogged as to involve heavy expenditure in renewal, only to be avoided by the timely maintenance of the wearing surface or crust.

In suitable cases where a sufficient thickness of surface metalling is known to exist, some saving can sometimes be effected by scarifying up the worn surface, and again consolidating by rolling, with the addition of a small amount of road metalling of a similar quality. This will result in a saving of new material, while the labour bill will not be affected. At the present time economy of material is of first importance in view of its greatly enhanced price and difficulties of transit by rail. Haulage to the various roadways is also increasingly difficult and expensive, owing to the shortage of horses, tractors, and labour due to war requirements.

TAR-PAINTING ROAD SURFACES.

In the case of roadways of light residential traffic, culs-de-sac, and such like, considerable saving is

possible by re-painting the surfaces when in a good state of repair, as, under suitable conditions, such surfaces will give satisfaction for several years at little or no expense.

Tar-painting is especially advantageous and economical mode of treatment on light-trafficked roadways as above and upon moderate gradients, as it prevents the disintegration of the roadway by excessive drought or heavy rain, stops the growth of weeds, and minimises scavenging costs.

On roadways subjected to much traffic the saving is not so marked, as the coating of tar has a much shorter life, but even here there is an undoubted economy in road metalling and a welcome reduction of the dust trouble in fine weather.

In times past the provision of public baths has been criticised as a luxury, but, in view of recent experience on the sea, it is well to know how to swim. Even in the absence of such experience there is a great deal to be said in favour of the municipal bathing establishment. Not that such institutions can be regarded as sources of revenue showing well in a balance-sheet, but their educative and health-giving facilities are unquestionable. In towns where soldiers are billeted baths and swimming ponds are of special value just now, and are much appreciated by the men, who, of necessity, have limited facilities for personal cleanliness in an ordinary billet or camp. The health-giving properties of a well-kept public bath are of more than local importance, and no curtailment should be sought just now under that head. Like the majority of public health work, it is a case of "casting bread upon the waters with the hope of finding it after many days," but this can scarcely be expected to happen at the end of the current financial year.

MAIN ROAD MAINTENANCE IN WORCESTERSHIRE.

By C. F. GETTINGS, M.INST.C.E., County Surveyor.

[The following particulars are reproduced from Mr. Gettings' fourth annual report.]

The estimate for the year was £103,095, and the expenditure £97,760 15s. 9d., leaving a balance of £5,334 4s. 3d. unexpended. The amount unexpended related principally to the Road Board scheme, as, although the full quantity of work provided for in the estimate was carried out, the conditions were found to be rather more favourable than anticipated. This balance will probably be absorbed by work that will have to be carried out at a later date. In view of the extraordinary conditions that have existed during the past twelve months I think we were fortunate in completing the whole of the work.

Apart from the Road Board scheme, the committee have followed up the practice adopted the last few years of strengthening some of the weaker roads in districts taking a fairly heavy traffic, and by this means we are gradually strengthening and bringing them up to a standard that is required for the present traffic. It is a slow process, but if followed up I think the benefit will be appreciated in a few years.

Last year we anticipated that a scheme of classification would be agreed upon, and that further assistance would be forthcoming from Exchequer funds. Unfortunately, owing to the war, this scheme has been held up indefinitely, and, although it is generally agreed that at an opportune time a scheme will have to be formulated, meantime the whole of the funds required for ordinary maintenance will have to be provided by the county.

MOTOR-'BUS TRAFFIC.

There are now motor-'bus services running over 192 miles of main roads in the county, the whole of which have been put into operation since September, 1912.

The motor-'bus service is used by a large section of the community, which has been the means of opening up a number of villages, and in some cases enhancing the value of property, but I fear that the convenience in regard to the cost of the upkeep of the roads is not generally appreciated. In many cases the expense is not restricted to surface damage, as additional expense is necessitated in widening and strengthening roads which hitherto have been sufficient for the ordinary slow-moving traffic of the district. It is generally admitted that motor traffic will most probably increase, and that the various users of the road must be asked to contribute their fair proportion towards the cost of upkeep.

TAR-PAINTING.

The work in connection with surface tar-painting was further extended and some 94 miles were treated at a cost of about £5,000. The committee agreed to add a number of lengths on important roads that had not been previously treated owing to their taking a considerable light motor traffic. Rather more than one-fifth of the total mileage of rural main roads are now surface tarred, and I am convinced that it would be economical further to extend the principle on some roads where long lengths of ordinary water-bound material is applied. As in previous years the work was carried out by our own staff, and was done in a satisfactory and expeditious manner.

LABOUR DIFFICULTIES.

Prior to the war we had some little trouble in various parts of the county in obtaining the full amount of manual labour required. Since that time, through approximately 100 men having joined the Forces and ammunition works (thirty-three of whom are receiving allowances from the county council), we have had very serious difficulties in carrying out the work expeditiously, and it has only been done by persuading men to travel considerable distances. Somewhat similar trouble has been experienced with team labour, and it is now quite impossible to complete the work without employing a large proportion of mechanical transport.

URBAN MAIN ROADS.

The necessary inspections have been made in the whole of the borough and urban districts—the standard has been improved in some cases, but there are a number of roads that are not in a first-class condition. I am still of the opinion that some of the authorities spend too much on street watering, especially where the surfaces are tar-painted, and that it would be more satisfactory if preference was given to additional scavenging.

A scheme, estimated to cost £12,000, was prepared and submitted to the Road Board for improving certain main roads in the following districts: Bromsgrove, Oldbury, Redditch and Stourbridge, and this was approved by the Road Board, but for financial reasons it has been deferred, excepting one section at Oldbury and another at Redditch.

ROAD BOARD WORK.

The five years' scheme commenced in May, 1913, was proceeded with continuously throughout the year, and practically the whole of the work allowed for in the estimate was completed. The expenditure during the year amounted to £21,401 10s. 6d., and £12,500 was received from the Road Board during the year on account of this scheme.

The work is still proceeding, but since the outbreak of war the rate of progress has necessarily been very much slackened owing to shortage of labour and difficulty in obtaining material. At the present time only three small gangs are engaged on the work as compared with five larger gangs at this time last year.

Up to March 31st last approximately 22 miles of the trunk roads had been reconstructed.

THE LILIAN BRADSHAW FUND.

LIST OF DONATIONS.

We are making this week a further appeal on behalf of the widow and child of the late Mr. F. E. G. Bradshaw, formerly borough surveyor of Tamworth, Staffs. The particulars of this sad case were fully set out in our issue of July 30th last, and the generosity of a number of readers has since enabled us to forward to Mrs. Bradshaw a sum of money which, while not large, has assisted to maintain her in comparative comfort up to the present time. The list of donations now stands as follows:—

	£	s.	d.
J. E. Webb, Poultry, E.C.	5	5	0
H. L. Wettern, Water lane, E.C.	3	3	0
Dodd & Dodd, Birmingham	2	2	0
Frank Massie, Wakefield	1	1	0
A. J. P.	1	1	0
J. E. Willcox, Birmingham	1	1	0
Editor, THE SURVEYOR	1	1	0
Arthur Salmon, Hove	0	10	0
S. H.	0	5	0
Anonymous	0	5	0
Total	£15	14	0

Activated-Sludge Experiments at Milwaukee.

By T. CHALKLEY HATTON, Chief Engineer, Sewerage Commission, Milwaukee.

[Tests of this new proposed method of sewage treatment on a more extensive scale than has heretofore been reported are described and the results summarised. Glass tubes, two small glass-window tanks, a large fill-and-draw tank and a continuous-flow tank of the same size are included in the studies which are being made at the Milwaukee sewage-testing station. Methods of air diffusion, volume and time of air application and careful cost records are features of the experiments. The report is reproduced from our New York contemporary "Engineering News."]

For the purpose of comprehensively replying to the very many inquiries received from engineers throughout the country interested in the new process of treating sewage by means of "activated sludge," the writer ventures to report the results obtained thus far in carrying out the process at the Milwaukee sewage-testing station, which is being operated under his direction.

In submitting the information contained herein the writer desires to state most emphatically that he has drawn no final conclusions as to the ultimate applicability of this process for the disposal of the sewage of Milwaukee, as there are many features yet to be studied before such conclusions would be warranted. But the results obtained have given sufficient promise to be helpful to those carrying out similar investigations and to other engineers engaged in sewage disposal studies.

The purpose of investigating the activated sludge process was to determine the following points, and the experiments so far undertaken lead to that end:—

(1) SEWAGE EFFLUENT.

(*a*) Reduction of suspended matters during various detention periods.

(*b*) Reduction of organic nitrogen during various periods of aëration.

(*c*) Clarification of liquor per hour aërated.

(*d*) Removal of bacteria per hour aërated.

(*e*) Volume of air and pressures necessary to effect the different degrees of purification.

(*f*) Economic depth of liquor in tank.

(*g*) Economic method of applying air.

(*h*) Cost of producing effluent at different degrees of purification.

(*i*) Effect of temperature on the process.

(2) SLUDGE.

(*a*) Proportion of sludge to liquor required to effect different degrees of purification.

(*b*) Character of activated sludge.

(*c*) Time and air required to produce activated sludge.

(*d*) Volume of sludge produced per 1,000,000 gallons of liquor treated.

(*e*) Best method of maintaining necessary proportion of activated sludge in aërating tanks.

(*f*) Moisture content of wet sludge produced from aërating tank.

(*g*) Length of time tank sludge will keep without serious putrefaction.

(*h*) Value of sludge as a fertiliser.

(*i*) Dewatering of sludge.

(*j*) Final disposition of sludge.

(*k*) Cost of disposing of sludge.

(*l*) Effect of temperature on sludge.

(3) CHARACTER OF TANKS.

(*a*) Fill-and-draw process.

(*b*) Continuous-flow process.

(*c*) Combination of both processes.

APPARATUS USED.

On March 6, 1915, a laboratory test was begun particularly to try out the best method of applying air prior to building a working tank. The apparatus for making this test consisted of two glass tubes 5 ft. long and 1⅝ in. internal diameter, set vertically. In the bottom of one tube a "filtros" plate was inserted.

Filtros is composed of quartz sand and some cementing agent combined under high temperature. It may be made of any required porosity by varying the fineness or coarseness of the sand. It is manufactured by the General Filtration Company, of Rochester, N.Y., and was furnished to Milwaukee in plates 12 in. square by 1½ in. thick.

In the bottom of the filtros plate a small glass tube was inserted through which the air is delivered to the bottom of the plate. This diffuses the air as it comes in contact with the sewage with which the larger tube is filled.

The second glass tube was plugged at the bottom and a small inner glass tube was inserted, with its open end terminating near the top of the plug. The air is discharged through this orifice into the sewage near the bottom, rising up through the larger tube in the form of bubbles, and thus keeping the entire body of the liquor agitated.

These tubes have been in fairly constant operation up to date. Some representative results obtained therefrom are noted at the beginning of Table 1. No attempt was made to measure the air used to obtain these results.

On May 8, 1915, two inspection tanks were placed in operation. These tanks, made of wood, were 10 ft. high, 5 ft. wide, and 1 ft. between sides, the bottom sloping to a 12-in. square in the centre. On each side glass plates were inserted at various depths to permit observations to be made of the interior.

In the bottom of one tank a filtros plate was inserted, 12 in. square by 1½ in. thick, and a ½-in. air pipe was attached to the cast-iron frame in which the plate was set.

In the other tank a ½-in. pipe was placed in the centre, terminating in an open end within 3 in. of the bottom of the tank.

Meters, U mercury tubes and valves were attached to each air feed to determine and regulate the air pressure and volume.

These inspection tanks were installed for the purpose of investigating the process under high and low temperatures, the economic method of applying air, the volume and air pressure required, the sludge characteristics and the period of sedimentation; also the most economic depth of liquor to be maintained.

The results are shown in Table 1, under "Glass-Window Tanks." The workmen about the plant have dubbed them the Annette Kellerman tanks, because they resemble somewhat the tanks used by the famous swimmer.

On March 26, 1915, the Fowler tank was placed in operation. This tank is so named because it was designed by Dr. Gilbert J. Fowler, of Manchester, England, who is advising with the writer in investigating this process. This tank is made of wood, 32 ft. long, 10½ ft. wide, and 10 ft. clear depth.

Fig. 1 shows how the Fowler tank was constructed. Filtros plates were used as air diffusers. These were built into a concrete channel; but this method was found unsatisfactory, because the cinders under the concrete contained the air after the pressure was shut off, and, during the sedimentation period, when it is necessary to maintain the liquor as quiet as possible, this entrained air persisted in rising to the surface and keeping the liquid considerably disturbed. To overcome this the plates were placed in cast-iron frames, as shown in detail in Fig. 1, and a ½-in. air pipe was tapped into the bottom of each frame. Since this has been done there has been less trouble with entrained air.

Rebuilding the bottom of this tank put it out of commission from April 14 until May 6, 1915, from which date it has been in continuous operation.

The air delivered to the tank is measured through a Venturi meter and recorded by a manometer furnished by the Builders' Iron Foundry. The air for the plant is furnished by a Connersville positive blower of the Boston type, operating to 5 lb. pressure and actuated by a d.-c. motor.

OPERATION OF THE EXPERIMENTAL UNITS.

The laboratory test tubes have been operated under varied conditions for the purpose of observing the characteristics of the process, and many interesting results have been obtained which have guided the operations in the other tanks. The record at the top of Table 1 represents the nitrogen cycle obtained with activated sludge, although 20 to 30 parts of nitrogen as nitrates have been frequently obtained with twenty-four-hour aëration.

When the two Kellerman tanks were placed in operation on May 8th, 25 per cent of their capacity

TABLE 1.—RESULTS OF ACTIVATED SLUDGE EXPERIMENTS IN GLASS TUBES AND SMALL TANKS AT MILWAUKEE, WIS.

(Parts per Million.)

Date 1915	Temperature, Deg. Fahr. Air.	Temperature, Deg. Fahr. Sewage.	Aeration. Hours.	Raw sewage — Nitrogen as — Suspended matter.	Raw sewage — Nitrogen as — Free ammonia.	Raw sewage — Nitrogen as — Nitrite.	Raw sewage — Nitrogen as — Nitrate.	Filtros diffusion — Nitrogen as — Free ammonia.	Filtros diffusion — Nitrogen as — Nitrite.	Filtros diffusion — Nitrogen as — Nitrate.	Vacuum diffusion — Nitrogen as — Free ammonia.	Vacuum diffusion — Nitrogen as — Nitrite.	Vacuum diffusion — Nitrogen as — Nitrate.	Number of bacteria per c.c. — Sewage — 20 deg. Cent.	Sewage — 37 deg. Cent.	Filtros — 20 deg. Cent.	Filtros — 37 deg. Cent.	Air jet — 20 deg. Cent.	Air jet — 37 deg. Cent.
								Glass tubes in laboratory (1:80 C.C. samples).											
March 31 ...	70	48	0	268	16·0	0·08	0·36	—	—	—	—	—	—	—	—	—	—	—	—
			2	Total	—	—	—	7·0	2·75	2·40	7·5	1·81	1·80	—	—	—	—	—	—
			4	Solids	—	—	—	0·96	1·60	6·40	1·0	1·14	3·60	—	—	—	—	—	—
			6		—	—	—	Trace	0·40	8·80	5·6	0·01	4·80	—	—	—	—	—	—
			8		124·7	—	—	Trace	0·19	9·42	Trace	0·05	4·80	—	—	—	—	—	—
April 1 ...	—	—	24		—	—	—	Trace	0·17	10·40	Trace	0·56	11·20	—	—	—	—	—	—
								Small glass window tanks, Kellermann's outdoors.*											
May 20 ...	54	54	0	257	12·6	0·24	0·40	—	—	—	—	—	—	7,62,000	14,000	—	—	—	—
			2	Total	—	—	—	8·0	1·7	3·8	12·6	0·0	7·8	—	—	142,000	—	108,000	—
			4	Solids	—	—	—	7·1	1·7	14·0	11·1	0·0	7·0	—	—	31,500	13,600	52,000	13,500
			24		—	—	—	4·9	0·0	24·0	9·0	0·0	12·0	—	—	6,700	1,800	10,700	5,300
	Volume of sludge, per cent							27			27			Volume of water, gal		124		124	
May 22 ...	54	55	0	235	9·6	0·45	2·00	—	—	—	—	—	—	1,20,000	50,000	—	—	—	—
			2	Total	—	—	—	5·0	1·8	12·8	0·6	0·7	10·4	—	—	50,000	5,000	52,000	5,000
			4	Solids	—	—	—	2·5	1·6	14·4	4·0	1·0	14·4	—	—	80,000	4,000	68,000	1,000
			6		112·7	—	—	1·0	0·8	16·8	4·0	1·4	19·2	—	—	11,000	1,000	11,000	1,000
	Volume of sludge, per cent							28			28			Volume of water, gal		124		124	
May 27 ...	46	52	0	290	9·1	0·42	1·60	—	—	—	—	—	—	1,25,000	120,000	—	—	—	—
			2	Total	—	—	—	4·0	0·9	9·8	0·6	0·2	4·1	—	—	—	—	—	—
			4	Solids	—	—	—	2·4	0·9	12·0	5·0	0·1	4·0	—	—	34,200	1,700	32,000	3,400
			6		—	—	—	Trace	0·8	13·6	5·4	0·0	4·0	—	—	—	—	—	—
	Volume of sludge, per cent							30			30			Volume of water, gal		124		124	
June 11 ...	59	59	0	272	11·6	0·34	1·80	—	—	—	—	—	—	1,70,000	80,000	—	—	—	—
			1	Total	—	—	—	7·1	0·08	4·0	8·1	0·20	2·92	—	—	74,000	6,000	135,000	12,000
			2	Solids	—	—	—	6·6	0·05	4·2	8·1	0·07	2·4	—	—	61,000	5,000	67,000	8,000
			3	1148	—	—	—	6·1	0·10	6·4	8·1	0·10	4·4	—	—	36,000	2,000	32,000	1,000
			4	—	—	—	—	4·5	0·11	8·0	6·6	0·20	4·2	—	—	42,000	2,000	26,000	1,000
	Volume of sludge, per cent							18			20			Volume of water, gal		124		124	

* The air was applied to these tanks at an average rate of ¼ cu. ft. per sq. ft. of surface area per min., or at a rate of 605,000 cu. ft. per 1,000,000 gals. per hour of aeration. The air was applied at following pressures in lb. per sq. in.: filtros, 3·6; air jet, 3·2

TABLE 2. ACTIVATED SLUDGE RESULTS IN FOWLER TANKS AT MILWAUKEE, WIS.*

Parts per million.)

Date 1915	Temperature Deg. Fahr., Air	Temperature Deg. Fahr., Sewage	Aeration. Hours	Raw sewage — Nitrogen as — Suspended matter	Raw sewage — Nitrogen as — Free Ammonia	Raw sewage — Nitrogen as — Nitrite	Raw sewage — Nitrogen as — Nitrate	Fowler supernatant liquor — Nitrogen as — Free Ammonia	Fowler supernatant liquor — Nitrogen as — Nitrite	Fowler supernatant liquor — Nitrogen as — Nitrate	Fowler supernatant liquor — Suspended matter	Fowler supernatant liquor — Putrescibility	Fowler supernatant liquor — Turbidity	Number of bacteria per c.c. — Raw sewage — 20 deg. Cent.	Raw sewage — 37 deg. Cent.	Fowler — 20 deg. Cent.	Fowler — 37 deg. Cent.	Volume of sludge in tank, per cent.
June 2 ...	59	58	0	129	1·20	0·00	0·30	—	—	—	—	—	—	2,800,000	250,000	—	—	—
			1	Total	—	—	—	1·52	1·20	0·20	0	48	Slight	—	—	31,000	2,000	9
			2	Solids				1·56	1·20	0·00	0	120	V. s.	—	—	19,000	1,000	—
			3					1·44	1·10	0·30	0	120	V. s.	—	—	2,000	1,000	—
			4	—	—	—	—	1·10	—	0·30	0	120	V. s.	—	—	—	—	—
June 8 ...	70	70	0	185	14·6	0·4	0·0	—	—	—	—	—	—	1,200,000	240,000	—	—	—
			1	Total	—	—	—	16·7	0·20	0·40	4	48	Slight	—	—	127,000	12,000	—
			2	Solids	—	—	—	17·2	0·00	0·67	4	120	V. s.	—	—	51,000	5,000	—
			3	957				18·7	0·00	0·72	0	120	V. s.	—	—	16,000	1,000	12
			4	—	—	—	—	16·2	2·00	0·84	0	120	V. s.	—	—	11,000	1,000	—
June 10 ...	48	58	0	170	16·0	0·42	0·0	—	—	—	—	—	—	2,180,000	150,000	—	—	—
			1	Total	—	—	—	18·0	0·70	0·50	4	40	Slight	—	—	135,000	11,000	—
			2	Solids	—	—	—	15·0	0·98	0·50	4	120	V. s.	—	—	110,000	8,000	13
			3	954	—	—	—	17·5	0·70	0·50	4	120	V. s.	—	—	170,000	12,000	—
			4	—	—	—	—	18·5	0·70	0·56	4	120	V. s.	—	—	75,000	5,000	—
June 12 ...	57	59	0	223	8·1	0·85	0·0	4·6	0·70	0·70	4	18	Slight	1,000,000	110,000	—	—	—
			1	Total	—	—	—	16·1	0·42	0·80	4	120	V. s.	—	—	780,000	6,000	12
			2	Solids	—	—	—	16·1	0·42	0·80	4	120	V. s.	—	—	760,000	5,000	—
			3	1026	—	—	—	16·1	0·42	0·70	4	120	V. s.	—	—	110,000	2,000	—
			4	—	—	—	—	16·1	0·42	0·70	4	120	V. s.	—	—	34,000	1,000	—

Analyses of sludge from the Fowler tank.

Date 1915	Specific gravity	Per cent. — Moisture	Per cent. — Solids	Per cent. of solids — Mineral matter	Per cent. of solids — Organic matter	Per cent. of solids — Fats	Parts per million — Phosphoric acid — Total	Parts per million — Phosphoric acid — Soluble	Parts per million — Oxygen consumed	Parts per million — Total Nitrogen
June 2 ...	1·014	97·7	2·28	9·56	1·62	0·12	1·05	0·23	5,700	1,920
June 9	1·008	97·8	2·16	9·72	1·49	0·13	1·71	0·00	5,400	1,600

* The volume of sewage in the Fowler tank was about 15,850 gals., and the [illegible] gals. per hour, at a pressure of about 4·1 lb. per sq. in.

was filled with sludge which had been artificially aërated for several days, although the nitrogen cycle was not complete. For several days thereafter fresh sewage was added, then aërated for twelve to twenty-four hours, allowed to settle, and the clarified liquor run off. This process was repeated until the drawn-off liquor was limpid in appearance and the organic nitrogen had been reduced to nitrates; what remained was the true "activated sludge." After this the tanks were operated on four and six hour cycles—that is, their contents were aërated for four and six hours, settled for half an hour, and then the supernatant liquor was drawn off and the tank refilled in another one and a-half hours.

The Fowler tank has been operated since May 6th on a six-hour cycle—that is, four hours aëration, half an hour settling, and one and a-half hours drawing and filling. A small volume of aërated sludge was placed in the tank when starting, but through a break in the connection of the draw-off pipe most of this was lost. However, since May 6th we have been trying to build up the volume of sludge so as to obtain 25 per cent of sludge to 75 per cent of liquor, but after forty-six days we accumulated only 13 per cent, during which time we treated 2,760,000 gallons of sewage. Measuring the volume of sludge after half an hour of settlement, we accumulated approximately 5 cub. yds. per 1,000,000 gallons, giving 98 per cent moisture when drawn.

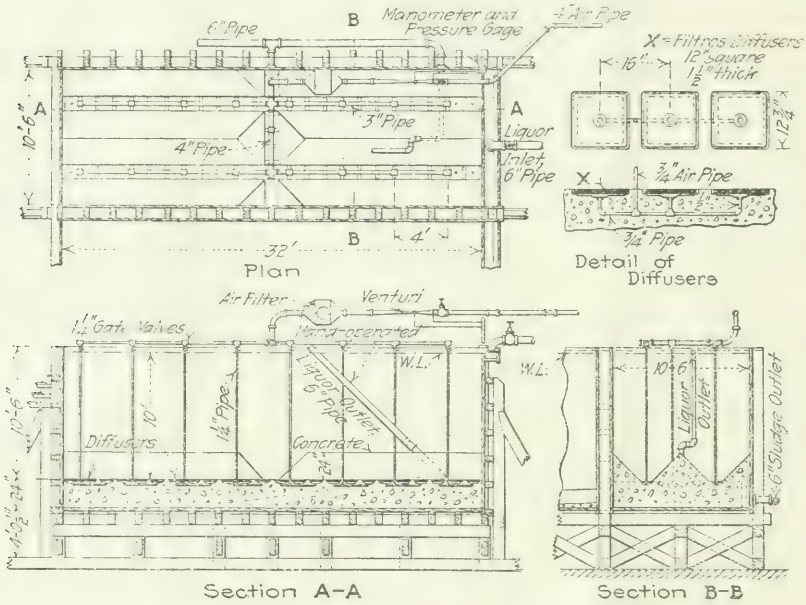


FIG. 1.—ACTIVATED-SLUDGE TANK AT MILWAUKEE—FILL-AND-DRAW-PLAN.

REMARKS ON THE RESULTS OBTAINED

Attention is called to the difference in volume of air used per 1,000,000 gallons of sewage treated in the small glass-window tanks, as shown by Table 1, and in the Fowler tank, as shown by Table 2. The cause of the excess in the former is that only 124 gallons of raw sewage was being added during each run, whereas 255 gallons should have been added to correspond with the same proportion being treated in the Fowler tank. Whether this increased air is the agent by which the effluent from the glass-window tanks is brought up to a higher standard than the effluent from the Fowler tank is uncertain; but the writer is of the opinion that it had very little effect, and that the higher standard is due to the presence of a sufficient volume of good activated sludge, which is not yet present in the Fowler tank.

In studying the results shown in the accompanying tables it must be borne in mind that the process is quite different from the aërating processes which have been investigated from time to time for a generation, in which air was used as an oxidiser and to separate the colloids by agitation or "scrubbing," leaving the colloids to pass off with the aërated liquor and again combine as soon as agitation was over. In the activated sludge process these colloids combine with the sludge intimately mingled with and at the same time separated from the liquor, and which contains a mass of nitrifying organisms absorbing the organic nitrogen in the sewage.

This is well brought out by two facts. Table 3 shows 1,580,000 bacteria per c.c. in the raw liquor. After four and a-half hours' aëration these had been reduced in the effluent to 8,000, or 99 per cent, whereas the sludge, after thirty minutes' settlement, contained 14,490,000 bacteria per c.c. The small glass-window tanks which had been operating with from 25 to 30 per cent of activated sludge have largely reduced the organic nitrogen to mineral nitrogen, whereas the Fowler tank, which has been operating with from 6 to 13 per cent of sludge, not completely activated, has shown very little, if any, reduction of the organic nitrogen—that is, the sludge plays a most important part in the process, and to do its best it must be thoroughly activated. Whether it is necessary to have a volume of sludge equal to 25 per cent of the volume of liquor is a point yet to be determined, but from the results shown by Tables 2 and 3 this does

TABLE 3.—BACTERIA IN MILWAUKEE ACTIVATED-SLUDGE TANK DURING DIFFERENT PERIODS OF AERATION.

	Time sample was taken.	Total bacteria per c.c. at 20 deg.	Total bacteria per c.c. at 37 deg.	Total red colonies per c.c.	Percentage of removal of total bacteria at 20 deg.	Percentage of removal of body bacteria at 37 deg.
Coarse-screened raw sewage	11.30 a.m.	1,580,000	160,000	100,000	—	—
End of ½ hour aëration	12 mid.	24[illegible],000	25,600	11,000	[illegible]·5	84·5
End of 1½ hours aëration	1 p.m.	200,000	16,000	7,000	87·3	90
End of 2½ hours aëration	2 p.m.	120,000	3,000	1,000	92	98
End of 3½ hours' aëration	3 p.m.	12,000	2,000	200	97	99
End of 4½ hours aëration	4 p.m.	8,000	1,000	—	99	99·4
Sludge after settlement	4 p.m.	14,490,000	1,380,000	370,000	—	—

* This record was made May 28, 1915, when the tank contained only 9 per cent. of activated sludge, on coarse-screened sewage of the strongest character obtained during the 24 hours.

not seem to be necessary to [illegible] stable liquor with [illegible] will be [illegible] the settling tank [illegible] the work [illegible] the capacity of tanks necessary.

Sufficient information has not yet been gathered to indicate what effect low temperature will have on the process. The Milwaukee sewage effluent is from sprinkling filters at the testing station reached a temperature of 42 deg. Fahr. during the past winter. The small glass-window tanks were started on July 6, 1915, on a series of tests to denote temperature effects, by keeping the temperature of the liquor in the tanks from 40 to 50 deg. Fahr.

Few investigations have been made of the sludge, because we have been unable so far to build it

readings are taken. The liquor treated is all measured volumetrically. An engineer is in charge of the work both night and day, under the direction of William R. Copeland, chief chemist, and the orders from headquarters are to record the truth.

So far the cost of air for treating the sewage in the Fowler tank is $1 per 1,000,000 gallons per hour aërated. This cost is based on electric current at 1c. per kilowatt-hour, a blower efficiency of 73 per cent and a motor efficiency of 90 per cent. The sewage commission has been tendered a proposition from the local electric company to supply current at the quantity required for pumping and blowing for 0·77c. per kilowatt-hour. A blower of 30,000 to 40,000 cub. ft. per minute, direct-connected to a steam turbine, will produce power at less cost than the electric unit. So far the cost bugaboo has not

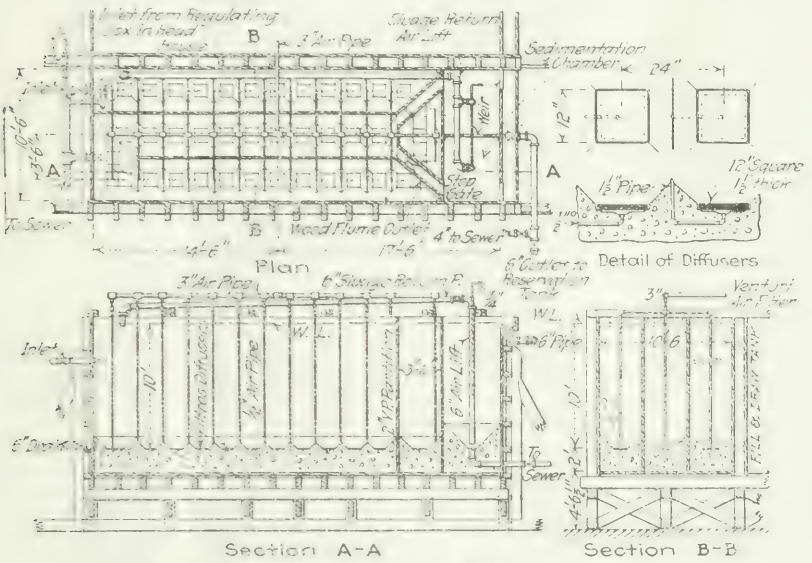


Fig. 2.—Continuous Flow Activated-sludge Tank at Milwaukee.

enough without robbing the tanks. The laboratory tests show a sludge which differs materially from either Emscher tank or septic tank sludge. It is not gaseous, like the former, nor does it retain its moisture, like the latter. It is granular in appearance, settles to the bottom, the clarified liquor coming to the surface quickly—that is, in four hours a sludge containing 98 per cent of moisture is reduced to from 75 to 80 per cent of its volume, containing about 75 per cent of moisture. The liquid separates from the sludge so quickly and effectually that there need be but little difficulty in drawing it off from a sludge tank and dewatering from the surface as well as from the bottom. The sludge gives off no odour when fresh; after being retained in open bottles for several days it turns from a medium brown to black and putrefies. There is no odour about the tanks while the sewage is being treated.

It is the intention to investigate thoroughly the treatment of the sludge as sufficient quantity accumulates.

From the beginning of the test it has appeared so simple to get a nearly sterile liquor after four hours' aëration, and the whole process has seemed so much more promising in general results than any other of the many processes being tried out at the testing station, that all connected with directing the tests have been fearful lest some overwhelming obstacle would arise which would make the process impracticable.

Several inquiries have suggested that the cost of air would prove to be prohibitive, as has been the case in investigations of other processes. To the end that the writer would not be deceived in this very important item, special attention has been given by all connected with the work to arriving at the cost of air. The best apparatus obtainable for measuring the volume and pressure of air used in each tank have been installed, and these are tested out every week. Every half hour of the twenty-four hours

materialised. It may appear with winter temperatures.

If this process can be satisfactorily carried out on the basis of continuous flow, both winter and summer, it will far excel every other sewage treatment to date where a stable, sterilised effluent is required. It is especially adaptable to being increased from year to year as population grows by simply adding to tank and blower capacity, and it largely circumvents the fool-killer.

For the purpose of testing the continuous-flow principle, a tank of 22,500 gallons capacity has been installed, and was put in operation on June 21st, and we hope by September next to be able to report some interesting results from it (see Fig. 2). It has been improvised from a chemical precipitation tank which has been thrown out of commission, and is of the same capacity as the Fowler tank.

As stated in the beginning, this article is submitted for the purpose of answering the many inquiries received from interested engineers, and incidentally for giving those parties working along similar lines the information obtained to date at the Milwaukee plant. The writer so far claims nothing except that there is no doubt that the Milwaukee sewage can be treated by this process, during at least eight months in the year, so as to produce a stable effluent at less cost than any other of the processes so far tested in the experiment station under his directions—and these processes have included fine screening, Emscher tanks, chemical precipitation, sprinkling filters, liquid chlorine disinfection and electrolytic disinfection.

Sand and Incendiary Bombs.—The Ilford Urban District Council are supplying sand to be placed in the front gardens of residents to assist the citizen street patrols to deal with fires caused by incendiary bombs.

Sewage Disposal in the Matlock District.

AN INTERESTING COMBINED SCHEME.

[The particulars given in the following article of the Scheme of Sewerage and Sewage Disposal for the Urban Districts of Matlock and Matlock Bath, and the Rural Districts of Bakewell and Belper in Derbyshire, supplement those which appeared in THE SURVEYOR of June 18th last.]

This is a combined scheme for dealing with the sewage from the health resorts of "The Matlocks" in Derbyshire, which are the centre of hydrography in the Midland Counties. Prior to the inception of this scheme many other schemes had been propounded by various engineers for the drainage of Matlock and Matlock Bath, both by separate and combined schemes. As a consequence there existed a very divided opinion upon the question in the district generally.

In the year 1904 the Matlock Council called in the services of Messrs. James Diggle & Son, civil engineers, of Westminster (who were then advising Matlock on water supply matters), "to go thoroughly into the question of the drainage of Matlock, and to recommend such a scheme (either separately for Matlock or in combination with Matlock Bath and the other adjacent districts) as in their opinion would be best for the communities as a whole—having regard in particular to the fact that both Matlock and Matlock Bath were health resorts, and that the first desire of Matlock was the preservation of the Matlocks from a health point of view."

In October, 1904, Messrs. James Diggle & Son reported in favour of one comprehensive scheme of drainage and sewage disposal for the four urban districts of North Darley, South Darley, Matlock and Matlock Bath, also for the township of Cromford in the Bakewell rural district, and for the townships of Tansley, Dethick Lea and Holloway in the Belper rural district.

After dealing extensively with various sites available for the purification of the sewage, the engineers recommended the one which has been adopted, situate in an ideal position in the valley of the Derwent, immediately below the Matlock district, and in close proximity to the Lea Tunnel on the Midland Railway. The site is in such a position and the levels are such that the whole of the above-mentioned districts can be drained to it by gravitation.

The scheme put forth by the engineers received the unanimous approval of the Matlock Council, but Matlock Bath had previously expressed itself in favour of a separate scheme for their district, and having deposited with the Local Government Board plans for such a scheme, which had not been sanctioned by the board in the Parliamentary Session of 1905, the Matlock Bath Council deposited in Parliament a Bill to enable them to obtain powers for the construction of their separate scheme for Matlock Bath. The proposal was strongly opposed by Matlock, for whom Mr. Diggle acted, and the Parliamentary Committee of the House of Lords refused to give their sanction to the Matlock Bath separate scheme. The Matlock Council afterwards opened out negotiations with the whole of the authorities previously referred to with the object of bringing about an amicable arrangement for the combined scheme.

The negotiations proved very tedious indeed and extended over a period of something like five years. Ultimately, however, the patient efforts of the Matlock Council and the engineers prevailed, and, with the exception of Darley and Tansley, the remaining districts referred to decided to come into the combined scheme upon terms which were amicably arranged in all cases with the assistance of Major Norton, R.E., engineering inspector to the Local Government Board, who held the public inquiry at Matlock on the first part of the scheme.

Tansley recently made overtures to come into the scheme, but no arrangement has yet been come to. The Matlock Council are, however, desirous that there should be no needless sewage purification works put down near to or on the borders of their district, and with that object in view the arterial sewers of the combined scheme in the vicinity of Tansley are to be constructed sufficiently large and at such a level (by tunnelling through hard mountain limestone) as will enable the Tansley sewage to be taken into the scheme and treated at the outfall works of the combined scheme, the feeling of Matlock being that it would be an act of spoliation, little short of vandalism, to dump down sewage purification works in such a pretty and much frequented district.

A "united district" under the provisions of the Public Health Act, 1875, has not been formed in this case, the burden of construction being wholly undertaken by the Matlock Council, who receive from the outside authorities certain contributions of capital towards the first cost of the works, with further annual payments for maintenance and upkeep of the works, treatment of sewage, &c., being according to the varying conditions of each district.

Although the scheme is a gravitation one, there exists a large low-lying area in Matlock, extending along the Valley of the Derwent from Bakewell-road to Crown-square, and thence to Matlock Green, in connection with which a system of Adams' sewage lifts is being adopted, the available fall of high-level sewage being about 38 ft. The approximate cost of the lifts, including air and forcing chambers, air and rising mains, will be £5,500 (exclusive of the high-level intercepting sewers).

Owing to the physical conditions of the district it is necessary to cross the river Derwent no fewer than six times, twice under the bed of the river with cast-iron pipes and four times above the river by means of steel girder bridges. Advantage has, however, been taken of these circumstances to secure public footpaths in much needed positions at three of the bridge crossings. The design of the bridges is also such that they add to the picturesque scenery of the Derwent Valley. The total cost of the bridges and river crossings, including footpaths, outfall sewer, &c., will be about £5,000.

In many places the construction of the sewers has necessitated very costly tunnelling work through mountain limestone at great depths below the surface, and the presence of enormous volumes of underground waters (including thermal waters with a temperature of 70 degrees) has necessitated extensive pumping operations and the construction of a considerable length of main outfall and other sewers in cast-iron. The precipitous sides of the Derwent gorge and the levels and configuration of the valley generally have also necessitated the construction of long lengths of river wall alongside the river to support the main outfall sewer.

When needful, automatic flushing tanks have been provided to secure adequate flushing; but in no case will the sewers have a less velocity than 150 ft. per minute.

The 24-in. diameter main outfall sewer has an inclination of 1 in 782.

The excess capacity of the sedimentation tanks over the usual fifteen hours' storage makes provision for the increased flows of sewage during the busy part of the season.

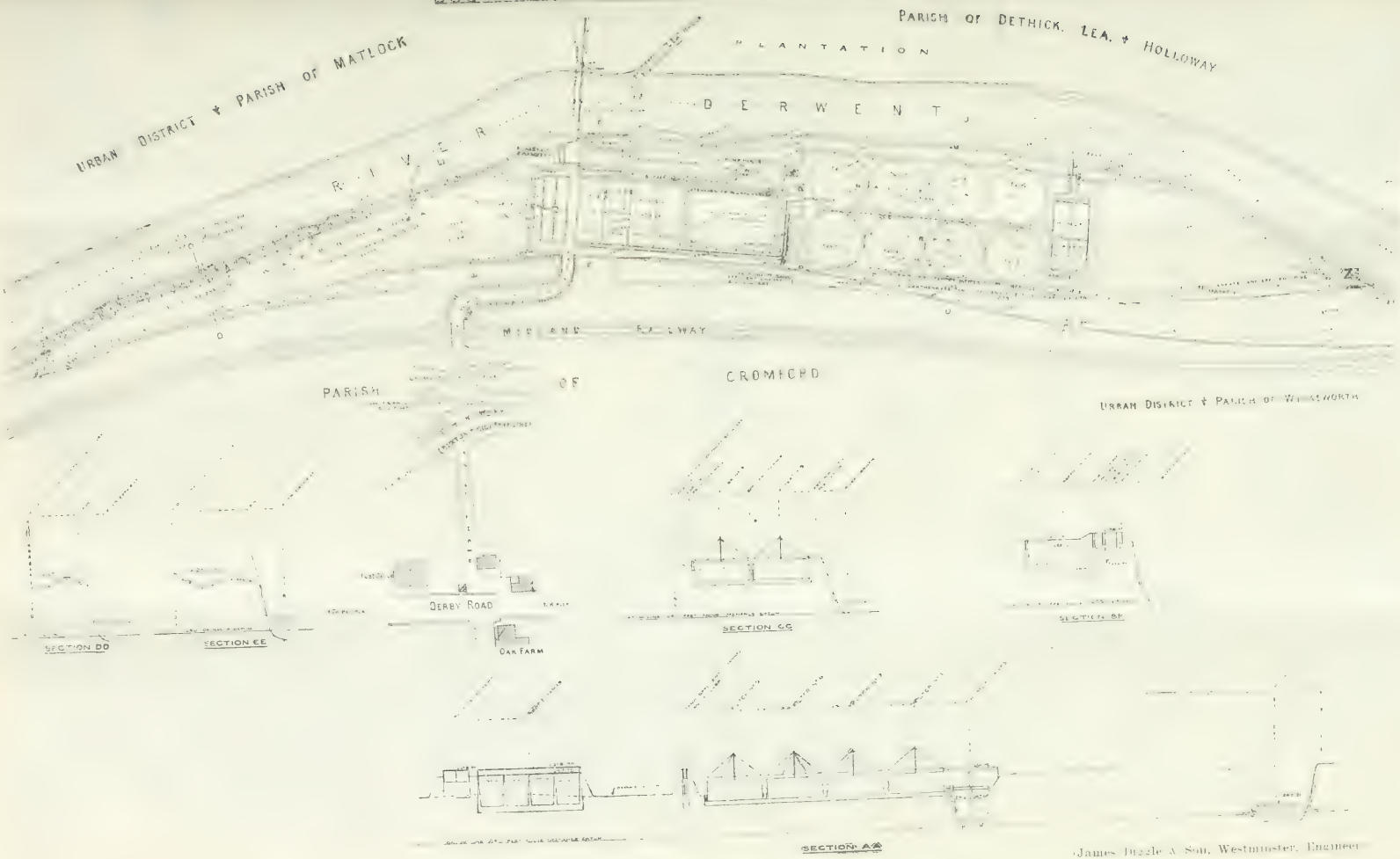
Dwarf walls 9 in. high have been constructed longitudinally on the floors of the sedimentation tanks to facilitate the easy removal of sludge, which will pass by gravitation into the sludge well (under the engine-house floor), and be pumped thence on to the sludge beds by two reciprocating pumps.

Each of the two humus tanks will have two compartments. At the outlet end of each tank there will be a coke shanning filter to arrest fine suspended matter.

The land filtration plots are fed by a 21-in. supply pipe direct from the sedimentation tanks—this pipe crosses the river Derwent diagonally by means of a cast-iron inverted syphon.

The land filtration plots will be a useful stand-by, by enabling periodical periods of rest to be given to the percolating filters, and securing ample means for dealing with the trade waters from Lea Mills (which are being brought into the scheme), and the increased flows of sewage from visitors, tourists and trippers who frequent the Matlocks throughout the whole of the year.

The total estimated cost of the combined scheme when fully completed, including about £14,000 for lands, easements, costs, engineering, clerk of works and contingencies, is £75,000, a part of which will be covered by contributions from outside authorities.



MATLOCK SEWAGE DISPOSAL WORKS. GENERAL SITE PLAN.

CORRESPONDENCE.

Εις ἀνὴρ οὐ πάντ' ὁρᾷ
(One man does not see everything.)
—Euripides.

CAMP SANITATION.

To the Editor of The Surveyor.

Sir, I beg to forward further sketches prepared from material supplied by Mr. S. Clifford Rigg, M.R.SAN.I., who is serving with the R.A.M.C. in France.

STORAGE AND SUPPLY OF DRINKING WATER.

The source is a lake 4 kilometres distant, and the water is delivered by gravitation through a pipe 9 centimetres (3½ in.) in diameter.

Before use a colour test is applied twice daily, and the water subsequently sterilised; the usual proportion is 1 part of chloride of lime to 1,000,000 parts of water.

The sketch shows four cast-iron tanks. Each of these measures 12 ft. by 8 ft. by 4 ft., and they are connected and mounted on a stout staging resting on strong wooden framing of sufficient height to allow the bottom of the tanks to be above the water carts. A wooden roof is provided.

The usual number of cartloads of water supplied per day is 200.

OPEN-AIR BATHS.

The selected site consisted of grass land with a slight inclination towards a watercourse. The subsoil is stiff clay, while the surface consists of sandy clay, consequently there is little, if any, downward filtration.

The fresh water is pumped from the watercourse into the storage tubs D. The cold supply to baths is obtained direct from these, while heated water is obtained from the coppers.

After use, the waste is tipped into the channels shown, both on plan and section Z; these deliver into catchpit No. 1, which has an overflow into No. 2. From the last-mentioned the waste is pumped on to the irrigation bed, which is former grass land, now dug over from time to time. Clean straw is scattered in the catchpits and in the channels, and this arrests a proportion of the soapy scum. All channels are covered by narrow battens, spaced and ledged together on the principle of snow boards, and as illustrated over the right-hand channel.

The effluent from land discharges into the third catchpit, and, presumably—I have no particulars on this point—it eventually reaches the watercourse.

The dressing compartment measures 24 ft. by 30 ft., while the "bath-room" is 20 ft. by 28 ft. Canvas screening 6 ft. high is fixed to both sides and ends.

DISINFECTION.

The work of disinfection appears to be of a large and varied character. For billets, barns, bivouacs, tents, dug-outs, gun-pits &c., Formalin or Creosal is used, according to specific requirements, and is generally applied by a spray of the type known as Mackenzie's spray.

Thresh's portable steam disinfectors are used for treating clothes, blankets, and similar articles.

Quicklime is used on carcases and chloride of lime in latrines.—Yours, &c.,

G. Bertram Hartree.

Town Hall,
Alton.
August 30, 1915.

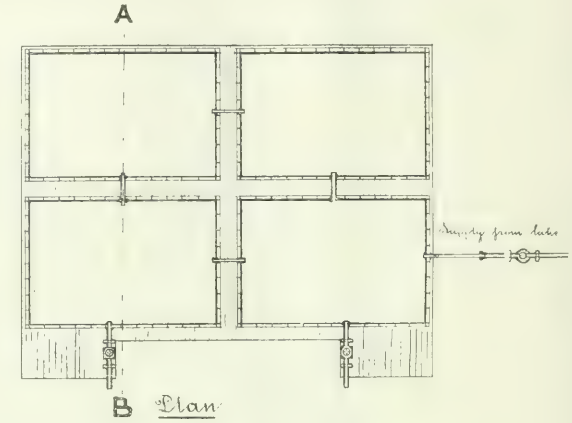
CONCRETE ROADS.

To the Editor of The Surveyor.

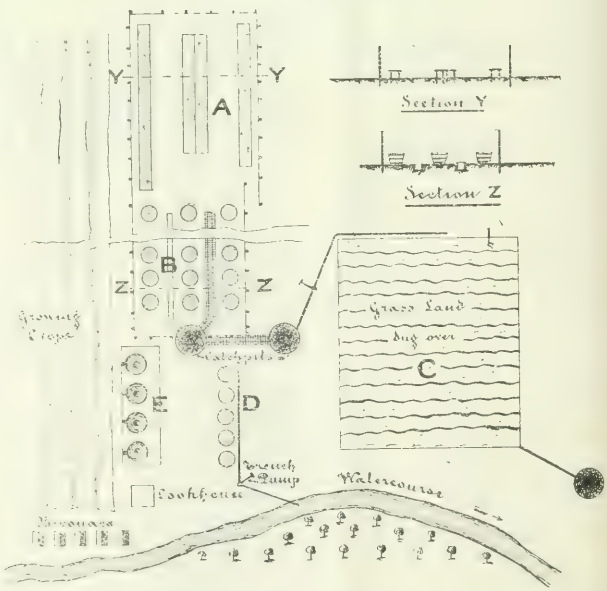
Sir,—In your issue of August 18th you ask, "Have not most of the attempts in this country to make good concrete roads hitherto proved a failure?"

All recent concrete-surfaced roads in this country have been reinforced concrete, or, if any others have been constructed, the particulars in regard to them have not been made generally known. It is some years since plain concrete roads were constructed, with lack of success, possibly owing to the poor quality of the concrete and the absence of reinforcement.

Owing to improvement in the quality of cement and the educational effect of reinforced concrete, concrete itself without reinforcement, generally speaking, is a much superior material to what it was ten years



Camp Water Supply.



An Open-air Bath (Hot and Cold) at the Front.

A—Dressing compartment. B—Bathing compartment. C—Disposal site.
D—Water storage tubs. E—Coppers.

The Surveyor
And Municipal and County Engineer.

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ago, and with the addition of reinforcement, concrete roads now have proved to be a thorough success.

There are not many examples of concrete-surfaced roads pure and simple, but to these should be added the reinforced-concrete culverts and bridges over which the traffic runs directly on top of the concrete.

Of concrete roads there are the following:—

Two roads at Chester
One road at Gravesend.
Some roads at Chiseldon Camp.

The roads at Chester, one of which is over two years old, carry medium and light traffic, and are an unqualified success. They were constructed at a very much lower cost than water-bound macadam; no repairs whatever have been necessary.

The road at Gravesend was subjected to heavy war traffic very soon after it was built. This road was on a hill in a damp situation, and, from all points of view, the test was far too severe for a new form of construction.

Reinforced-concrete surfaces are not at present recommended for heavy traffic, or rather for shod wheels, and the Gravesend road, therefore, as a test is not condemnatory of reinforced-concrete roads for the traffic for which they are recommended.

The reinforced-concrete roads constructed for the War Office at Chiseldon have only just been finished, and have not been sufficiently long in use to form evidence either one way or the other, except that long stretches of road have been constructed without joints and subjected to fair extremes of temperature without any cracking.

Apart from any other evidence, the roads at Chester conclusively prove that reinforced-concrete surface roads can be constructed at a lower cost than water-bound macadam, and will carry light and heavy traffic with maintenance charges practically nil. (The average maintenance charge of some millions of square yards of concrete roads in the United States is considerably less than ¼d. per square yard per annum.)—Yours, &c.,

J. F. BUTLER, Secretary.
The British Reinforced Concrete Engineering Company, Limited.

1 Dickinson-street,
Manchester.
August 26, 1915.

SIX VACANCIES.

To the Editor of THE SURVEYOR.

SIR,—The War Office have just increased the establishment of this company, and there are vacancies for three surveyors and three draughtsmen.

There is no need to make an appeal. But there are probably many young men still engaged in municipal and other offices awaiting an opportunity of joining a branch of the Service in which use would be made of their previous training and experience.

Such recruits would be very welcome. Application may be made to the Recruiting Officer, Nuneaton, or I should be happy to reply to any letters addressed to the Municipal Offices, Nuneaton, which would be at once sent on to me at our training centre in the South of England.—Yours, &c.,

F. C. COOK, Captain.
Commanding 216th (Army Troops) Company R.E.
August 31, 1915.

LAYING OF SEWER PIPE.

[The adoption of the following practice for the laying of sewer pipe was recommended by a committee of the American Society for Testing Materials at the annual meeting of that body recently.]

The foundations in the trench should be formed to prevent any subsequent settlement and thereby a rupture of the pipes. If the natural foundation is rock it is recommended that an equalising sand bed be placed upon the rock and well compacted by watering or otherwise so as to obviate irregular settlement. If the natural foundation is good firm earth, the earth should be pared or moulded to give a full support to the lower third of the pipe. Otherwise the bed should be made firm, either by sand well watered or rammed, or by a layer of cement mortar. The same means of securing a firm foundation should be adopted in case the excavation has been made slightly deeper than necessary.

If there is no good natural foundation, a firm and sufficiently broad bed should be artificially made either with sand, with gravel or broken stone, with concrete, reinforced concrete, or other means to secure a solid and firm foundation.

If the soil is porous and ground water rises above the sewer pipe, a plank foundation with or without piles may be required.

When the sewer is to be laid in a concrete cradle, the concrete for the full width of the cradle should be continuously deposited to the height of the outside bottom of the pipe. Before the concrete has set the pipe shall be evenly bedded therein and the remainder of the concrete immediately placed on each side of the pipe and carefully tamped in such a manner as to avoid disturbing its position. Or the pipe may be supported and held in position by wedges or templates, and the concrete mixed wet, and poured under and around it in such a manner as to complete the cradle in one operation.

When the sewer is to be laid in a gravel or broken-stone cradle the material should consist of clean gravel or sound broken stone, all of which should preferably pass through a screen of 1-in. mesh and be retained on one of ¼-in. mesh. The gravel or broken stone should be deposited and consolidated for the full width of the trench to the height of the outside bottom of the pipe. The pipe should then be bedded therein and the remainder of the gravel or broken stone deposited and carefully consolidated in such a manner as to avoid disturbing the position of the pipe. The cradles should in all cases be so constructed that an undue proportion of the load shall not be borne by the hubs.

If the trench is situated in ground water, it is recommended to lay the pipe in a concrete cradle up to the springing line.

When a sewer is to be laid without a cradle the earth forming the bed should be carefully freed from stones and organic material. The pipe should then be evenly bedded therein, the joints properly made, and the back-filling placed and firmly tamped in such a manner as to avoid disturbing the position of the pipe.

When pipe is laid in soil which is not sufficiently firm to carry it, the earth or soil should be removed, and sufficiently broad foundations and retaining supports substituted.

When pipe is to be laid in new embankment the fill-up to a point over the springing line of the pipe should be deposited in layers not exceeding 6 in. and thoroughly consolidated by rolling, ramming, teaming, watering, or a combination of these, depending upon the nature of the filling material, whether it is clay, sand, gravel, or a mixture of these.

If a pipe line is situated on one side of an embankment where the soil is liable to lateral move-

ments, and is thus subjected to a one-sided load or pressure, care must be taken to secure a stable foundation, so that the pipe line will not be moved on its bed. A retaining support should be placed at the side having the less pressure. It should be made of suitable material, of proper height and weight, to transfer to the foundation the excessive lateral earth pressure, without danger to the stability of the pipe line.

Trenches should be kept free from water until the material in the pipe joints has hardened sufficiently so that the pipe line will be continuous and strong.

The stresses produced in pipe by the back-filling will differ according to the conditions of the soil. In self-sustaining soil it is possible to lay pipe at a considerable depth without producing excessive stresses. In soil which permits of lateral movement, or which is water-carrying, special precautions are necessary.

To protect pipe lines from unusual stresses all work should be done in open trenches. Tunnelling should be prohibited, except with the special consent of the engineer.

Pipe lines should be placed at such a depth below the surface of the street that dangerous pressure or impact cannot occur. If it is not possible to do this, special reinforcement is required.

Rock excavation should be made to a depth of at least 4 in. below the outside bottom of the pipe, or as shown on the plan.

Width of trenches in earth should be sufficient to provide a free working space of from 6 to 12 in., exclusive of spurs and hubs, according to the size of the pipe and the character of the ground.

The width of trenches in rock should be sufficient to provide a free working space of 12 in. on each side of the pipe, exclusive of spurs and hubs.

In every case there should be sufficient space between the pipes and the sides of the trench to make it possible to thoroughly ram the back-filling around the pipe and to secure tight joints.

If soil conditions and ground water require the use of sheeting, sheet piling and bracing, the trenches should be made correspondingly wider. The sheeting should be closely driven, and to such depths as the soil conditions may indicate.

Steel sheeting may be used with advantage where the flow of ground water into the trenches is excessive and the stability of the foundation soil and of the sewer is affected thereby.

Where a trench for a proposed sewer or extension of a sewer terminates in rock, it should be excavated for a distance of not less than 5 ft. beyond the end of the sewer and in the direction of the proposed extension. The pipes and all other structures should be carefully protected from the effects of blasts.

PIPE LAYING.

The laying of pipes in finished trenches should be commenced at the lowest point, so that the spigot end points in the direction of flow.

All pipes should be laid with ends abutting and true to line and grade. They should be fitted and matched so that when laid in the work they will form a sewer with a smooth and uniform invert. Unless otherwise permitted or directed, not less than 20 ft. of pipe sewer should be laid in one operation.

It is necessary to use all possible care when shoving the pipes together, so that mortar will not be shoved into the hub or the joint be unnecessarily large.

Sockets should be carefully cleaned before pipes are lowered into trenches. The pipe should be so lowered as to avoid unnecessary handling in the trench. After the end of the pipes have been sufficiently wetted, the hub end should receive upon its lower half a layer of mortar composed of 1 part of Portland cement to 1 or 2 parts of fine sand.

The pipe should be set firmly according to line and grade, and the joint carefully adjusted, filled with mortar and finished to a smooth bevel outside. The inside of the pipes should be then cleaned of dirt and mortar refuse. In small pipes the inside should be made smooth by a hand swab. Large pipes should be laid with block and tackle, and bar and tongs.

Gasket and mortar joints should be made in the following manner: A closely twisted hemp or oakum gasket of suitable diameter, in no case less than ¾ in., and in one piece of sufficient length to pass around the pipe and lap at the top, should be solidly rammed into the annular space between the pipes with a suitable caulking tool. Before being placed the gasket should be saturated with neat cement grout. The remainder of the space should then be completely filled with plastic mortar mixed 1: 1, and the joint wiped inside and finished to a smooth bevel outside.

Where butt or bevel joint pipes are used, the following method of joining is recommended: After a layer of mortar about 8 in. wide has been prepared at the joints, a wire netting is spread upon the same and covered with a layer of mortar about 1 in. thick. Upon this wire netting, which is embedded in the mortar, forming a bandage, the pipes are laid and adjusted according to line and grade. The bandage is then raised on both sides of the pipe, bound at the top, and covered with a layer of strong cement mortar at least 2 in. thick. The inside of the joint is finished in the same manner as specified for hub-and-spigot pipes.

The ends of pipes which enter masonry should be neatly cut to fit the face of the masonry.

No pipe or the cradle thereof should be laid or placed until the sub-grade of the trench has been tested and found correct.

In deep cuts, in high embankments, or in poor soil, it is recommended to use especially strong pipes or concrete reinforcement.

The smaller sizes of cement or concrete pipes should preferably have flat bases. If of sufficiently large diameter, they may be reinforced.

When mortar or concrete are to be mixed or placed in freezing weather, the following precautions are advised: No concrete should be laid when the temperature of the air is below 24 deg. Fahr. When the temperature is between 24 and 32 deg. Fahr., and rising, the mixing water should be heated to a suitable temperature, or, if directed, 1 per cent of salt, by weight, should be added for each degree of Fahrenheit of air temperature below 32 deg. Fahr. Under such conditions other materials for concrete and mortar should all be heated.

BACK-FILLING TRENCHES.

All trenches and excavations should be back-filled immediately after the pipes are laid therein, unless otherwise directed. The back-filling material should be selected and deposited with special reference to the future safety of the pipes. Clean earth, sand, or rock dust should be used up to a level at least 2 ft. above the top of the pipe. This material should be carefully deposited in uniform layers about 6 in. in depth. Unless otherwise permitted, each layer should be carefully and solidly tamped or rammed with proper tools, so as not to injure or disturb the pipe line. The back-filling material for the remainder of the trenches should contain no stones over 10 in. in their largest dimensions, should be spread in layers, and thoroughly consolidated by tamping or otherwise as the engineer might direct. Stones which are used in back-filling should be so deposited through the mass that all interstices are filled with fine material.

Where the safety and stability of the pipe line and other structures render it necessary, sheeting should be left in place, particularly below the top of the pipe.

When sheeting is withdrawn, all cavities remaining or adjoining the trench should be solidly filled. When the sheeting is left in place, all cavities behind such sheeting should be solidly filled.

For retaining back-filling temporarily, timber bulkheads may be used. They should be removed as the trenches are back-filled.

Puddling or water flooding for consolidating the back-filling is recommended only for sandy and gravelly materials. If this method is used, then the first flooding should be applied after the back-filling has been compacted by tamping up to the springing line of the pipe, and the second flooding during or after the subsequent filling of the trench. An excess of water should be avoided, in order to prevent disturbance of the earth under and around the pipe, and also to prevent an undue excess of pressure on the pipe.

Walking or working on the completed sewer, except as may be necessary in tamping or back-filling, should not be permitted until the trench has been back-filled to a height of at least 2 ft. over the top of the pipe.

Where a one-sided pressure exists, due to unbalanced loading, the filling of the trench should be carried on simultaneously on both sides and in such a manner that injurious side pressures do not occur.

In freezing weather back-filling should not contain any frozen lumps of earth below a level at least 2 ft. above the top of the pipe.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

The Editor, c/o Bailey House, 31 Bride-lane, Fleet-street, E.C., is prepared to receive and publish communications from students, and is glad to be favoured with letters from them. He is also prepared to answer questions, and will be glad to receive suggestions as to subjects which students would like to see discussed in this section. *Students are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the best communications, one or more premiums in books will be awarded monthly. Diagrams must be drawn in suitable shape and neatly for reproduction.*

THE MONTHLY PREMIUM.

The Editor has awarded the Monthly Premium to

MR. E. HOPKINSON,
25, Wood-road,
Walkden, Manchester,

for his answer to question 495, on the equation of the parabolic curve for the junction of two gradients.

QUESTIONS.

The following questions are invited for the ensuing month:—

498. Buttress Design.—Thirty feet (30 ft.) above the ground a rectangular buttress bears a thrust of 5,000 lb. inclined at an angle of 45 deg. If the buttress is to be 3 ft. wide, and is built of masonry 140 lb. per cubic foot, find its thickness. Also find the height of a turret 3 ft. by 3ft. necessary for stability at the top, and if the coefficient of friction be 0·6. (F. P. C., *Loughborough.*)

499. Geodesy.—Describe generally (without details) the astronomical observations needed to locate the starting point of a survey in a new country. (F. P. C., *Birmingham.*)

500. Sewage Tank.—A sewer discharging into a sea outfall is connected to a storage tank l feet in length, b feet in breadth, and h feet in height. The tank discharges directly into the sea by means of an orifice a square foot in area, connected to low-water level by a short pipe of the same area, the top of the tank being at high-water level. Neglecting losses due to friction, and assuming that no sewage is admitted to the tank during the period of emptying, that the tide has a range of r feet, and that the tide curve is harmonic, find approximately the time taken to empty the tank. (Stud.Inst.C.E.)

501. Ventilation.—In designing a system of ventilation for a public hall, what are the relative advantages of a small number of large inlet shafts, compared with a large number of small shafts; and at what level should these inlets be placed? (C. W. P., *Wellington.*)

502. Theory of Beams.—The cross-section of a beam [illegible] thick, the vertical web is 5 in. deep and ¾ in. thick. At a certain cross-section this beam is subjected to a [illegible] Make a [illegible] and find the [illegible] (C. W. P., *Wellington.*)

503. Sewer Construction.—AB and CD are two [illegible] pipe sewers intercepted at right angles by a railway in a cutting with slopes of 1 in 2. [illegible] AB = 1 in 140 and CD 1 in 300. The [illegible] B = 132·0, C 120·7, [illegible] level 128·0 and [illegible] 100·0 above ordnance datum. Distance from B to C is 110 ft. Describe and show by sketches in detail how to connect the sewers AB and CD, showing provision for cleaning and inspection. The fall of both sewers is towards D. The railway company will not allow any [illegible] greater depth from top of sewer to top of rails of 4 ft. (L. H., *Walsall.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

497. Gauging Sewers. Describe a suitable method for gauging the flow of sewers.

There are several methods, more or less accurate, for gauging the flow of sewers, some of which [illegible] can be described.

(1) Knowing the diameter of the sewer, its inclination and the depth of flow, the velocity can be calculated, and consequently the discharge. In this case the only measurements to be taken are the depths of flow at intervals during the twenty-four hours, and the average of such depths is taken for the purpose of calculating the daily flow. The velocity can be found from Chezy's formula

$$v = c\sqrt{mi},$$

where v = velocity in feet per second,

c = coefficient depending upon the size and condition of sewer, usually value of c is between 80 and 110,

m = hydraulic mean depth $= \frac{\text{area of flow}}{\text{wetted perimeter}}$

i = inclination of sewer.

Having obtained the velocity, the discharge is found from the following:—

$Q = AV$ where Q = discharge in cubic feet per second,

A = area of flow in square feet,

V = velocity in feet per second.

The only difficulty to be experienced in the velocity formula is the factor m, which is—

$$\frac{\text{area ACBD}}{\text{length ACB}}$$ in Fig. 1,

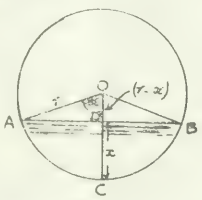

FIG. 1.

$$\frac{\text{area of sector ACBO} - \text{area of triangle AOB}}{\text{length ACB}}$$

$$\frac{a - OD.AD}{\frac{2\pi r}{360}}$$

since DC = x is known (i.e., measured) and r is known a is known, as $a = \frac{\theta}{360}$ and can be found from tables and expressed in radian measure)

As a practical example, sewer 18 in. diameter, having full $\frac{3}{4}$ and say depth of flow 6 in.

In this case $r = \frac{3}{9} = \cdot3333$ $\quad a = 70°\,32' = \frac{529\pi}{1350}$

$$\frac{\text{area}}{\text{wetted perimeter}} = \frac{\frac{81 \cdot 529\pi}{1350} - 3 \cdot 849}{2 \times 9 \cdot \frac{529\pi}{1350}}$$

$$= \frac{73{\cdot}44}{22{\cdot}15} = \cdot333 \quad \cdot275'$$

and $c = 100$ (say), and $V = C\sqrt{mi}$

$$V = 100\sqrt{\cdot275 \cdot \frac{1}{300}}$$

3·2 ft. per second and $Q = AV$

$$\therefore Q = \frac{73{\cdot}44}{144} \times 3{\cdot}2 = 1{\cdot}63 \text{ cub. ft. per second}$$

10·18 cubs. per second.

(2) The second method is by ascertaining the velocity of the flow by means of floats or colouring matter. The floats or colouring matter can be introduced into the sewer at a manhole, and the exact time taken to traverse a known length of sewer to another manhole is noted. The length of the section (which should be as long as possible) in feet, divided by the time in seconds, gives the surface velocity v in feet per second. The proportion which the mean velocity of the sewage bears to the surface velocity v according to

Neville (for velocity less than 10 ft. per sec.) is ·816 v

Box (for velocity less than 10 ft. per sec.) is ·84 v

Hence the discharge Q cub. ft. per sec. = area of

flow in square feet × mean velocity in feet per sec. If the discharge is required in gallons per sec., Q should be multiplied by 6·25. The floats should be made of wood of such specific gravity as to float with over half their thickness submerged. Should it be decided to use colouring matter, milk of lime, fluorescene, or potassium permanganate could be employed.

(3) The third method is to construct a temporary weir in a manhole of the sewer and measure the flow of sewage through a rectangular notch in the weir. Measurements of the depth of flow over sill should be taken at intervals during the period under consideration (say twenty-four hours), and the average depth is taken for the purpose of calculating the daily flow. In this method, as well as in the two foregoing methods, the observations should be continued daily over a considerable period, during all kinds of weather, so as to arrive at a true result. The discharge through the notch is given by the following formula:—

$$Q = \tfrac{2}{3} c l \sqrt{2g}\, H^{\frac{3}{2}}$$

where l = length of notch in feet,

H = height in feet of free level above sill,

Q = discharge in cubic feet per second,

g = force of gravitation = 32 ft. per sec. per sec.,

c = coefficient varying with H and l.

With values of H between ·25 and 2, and l not less than 2, the coefficient c is fairly constant, and may be taken as ·62. The following are the practical points to be attended to in this method: (*a*) The horizontal edge of the notch over which the sewage flows must be fixed perfectly level, and must be bevelled so as to present a thin edge on the up-stream side. (*b*) The depth of sewage below the sill of weir on up-stream side should not be less than three times the depth of sewage flowing over the weir. (*c*) A thin steel rule should be used for all measurements. (*d*) The weir should be placed in the manhole in such a position as to produce maximum pooling effect, so as to avoid having to allow for velocity of approach. (J. G. W., *Downpatrick.*)

It is rather a difficult matter to obtain an accurate gauging of the flow of water in sewers, unless they have a free discharge at the outlet, and can be made to deliver into tanks, &c., the capacity of which is easily ascertained. In high-level districts, where the sewer has a ramp, or drop into a manhole, the discharge may be accurately determined by blocking up the low-level outlet of the manhole, allowing the sewage to rise to a mark some short distance below the high-level sewer, and commencing to bale out the water with vessels of known capacity, carefully timing the commencement. After a considerable quantity of sewage has been baled out, stop baling and note the exact time when the sewage again rises to the mark in the manhole; the difference between this time and the time of commencement will be the time taken by the sewer to discharge the known quantity baled out. This method is, of course, not practical when there is no drop in the sewer, as the backing up of the sewage would seriously affect the flow. Where there is no drop, boards should be fixed across the sewer and the water backed up and made to flow over a rectangular or triangular notch. It is desirable that the channel on the upper side should be wider and deeper than the notch, to prevent the sewage approaching with sensible velocity. If the area passing through the notch is more than one-fifth of the area of approach the velocity must be taken into consideration; to avoid sensible velocity the depth of water below the sill of the notch should be at least three times the depth of water flowing over, and the sides of the approaching channel the same distance from the ends of the notch. Under these conditions the formula for a rectangular notch will be $Q = 3{\cdot}33\ (L - 0{\cdot}2\,H)\ H^{\frac{3}{2}}$, where Q = cubic feet per second, L = width of notch in feet, and H = head of water flowing over notch, in feet. When the velocity of approach has to be considered the formula becomes—

$$Q = 3{\cdot}33\,(L - 2H)\left\{(H + h)^{\frac{3}{2}} - h^{\frac{3}{2}}\right\} \text{ where } h = \frac{V^2}{2g}$$

and V = surface velocity taken at centre of stream in the sewer. Where the pipe is of uniform cross-section throughout a considerable straight length, Q may be found by determining the area in feet of the cross-section of the flow and multiplying by the velocity. The velocity required is the mean velocity, which, with slight variation, takes place at three-fifths the depth of the stream, and may be ascertained by means of a current meter inserted at this depth. It may also be obtained by means of floats; it being estimated that a rod float 0·94 of the depth of the flow gives its true mean velocity. It has also been estimated as 0·83 of the surface velocity taken at the centre of the stream. Another method is to drop some coloured liquid, of about the same specific gravity as the sewage, into the stream just above the point of observation, when a small cloud of colour is formed which gradually becomes elongated owing to the various velocities at different depths. The time should be carefully noted when the *centre* of this cloud passes the two points of observation; some difficulty will be experienced in determining the true centre, but under ordinary conditions in sewers very fair results may be obtained. For gauging small and variable discharges a triangular notch is most suitable, the formula for a right-angled triangular notch being $Q = 2{\cdot}635\ H^{\frac{5}{2}}$, H = height in feet from bottom of notch to level of still water, and Q = cubic feet per second. (P. W., *Pontypridd.*)

The usual method of gauging sewers is known as the "Q = AV" method, Q being the flow, A the cross-sectional area of the sewage, and V the mean velocity of the sewage. If the sewer be circular, the cross-sectional area is easily found; but if it be egg-shaped it is best to draw a section to a fairly large scale, and from it to obtain the area and perimeter. If preferred, such works as Molesworth's "Pocket-book of Engineering Formulæ" give values for these quantities for all ordinary dimensions of sewer. The velocity can be obtained either from a current meter or from the formula—

$$V = c\sqrt{mi}$$

where V = velocity of sewage in feet per second,

m = hydraulic mean depth,

$$= \frac{\text{cross-sectional area of sewage}}{\text{wetted perimeter}}$$

i = sine of inclination of sewer,

c = a constant, which is most accurately obtained from Ganguillet and Kutter's formula—

$$c = \frac{41{\cdot}6 + \dfrac{1{\cdot}811}{n} + \dfrac{{\cdot}00281}{i}}{1 + \left(41{\cdot}6 + \dfrac{{\cdot}00281}{i}\right)\dfrac{n}{\sqrt{m}}}$$

n is the coefficient of friction, and in the case of sewers in good order varies from about ·011 to ·013. The latter method for obtaining v is to be preferred. Take a numerical example: A circular glazed-stoneware sewer, 15-in. in diameter, is running half full. Find the flow past a given fixed point in gallons per minute. Assuming that the gradient of the sewer is 1 in 100, and that C = 125.

From the above we have $V = c\sqrt{mi}$

$$= 125\sqrt{\frac{15}{12 \times 4} \times \frac{1}{100}}$$

$$= 1{\cdot}4 \text{ feet per second}$$

For pipes of circular section H M D $= \frac{d}{4}$

$$Q = AV = \frac{3{\cdot}142 \times 15 \times 15 \times 1{\cdot}4}{144 \times 4 \times 2} = {\cdot}859 \text{ cub. ft. sec.}$$

$\therefore$ flow = ·859 × 60 × 6·25

= 321·97 or 322 galls per minute.

The gradient of the sewer can be readily obtained from a section, or levels can be taken at adjoining MH's. The current meter method is quicker, but is not to be recommended, except as a check. (B. K., *Newport.*)

Dearer Gas at Leeds.—At a meeting of the Leeds City Council held on Wednesday, a proposal to raise the price of gas by 3d. per 1,000 cub. ft. was carried. The step was justified by the statement that the coal contracts provided for an increase of 5s. upon those of 1914. This would involve an increased cost of £54,000.

Prestatyn Sewerage and Water Schemes.—The Prestatyn Urban District Council, after years of deliberation, this week adopted the new sewerage scheme, which is estimated to cost £20,000. The Local Government Board are also to be asked to sanction a scheme for the filtration and softening of the water supply, the cost of the plant being about £4,000.

EXAMINATION QUESTIONS IN ROAD CONSTRUCTION.

A reader has written expressing his warm appreciation of the series of "model" questions in road construction which we printed last week, and suggesting that the following are the correct answers, and that he is therefore entitled to a diploma. We give the questions again, with our correspondent's answers after each, and leave it to our readers to judge whether the latter are correct or not.

(1) (a) Will tar or pitch make a "carpet" on a road "bed"?

(b) Has a "seal-coat" anything to do with a seal-skin, especially when "patched"?

(c) Must the bed be a "cushion bed"?

To save pitching.

No. More probably a rabbet.

If the haunches and quarters have been scarified, yes.

(2) What makes the best "dish" of the following articles—"Stone grapes," "Chips," "Herring-bone," or a "Sub-crust"; are they "meaty," and which of them is the best "filler"?

The stone grapes are assumed to be in bunches. A "cooker" would be required, also "cups," "dish" and "kettle." Licking up would be very improbable.

(3) Has the "breeze" on the surface of a road anything to do with the "waves"?

If the road winds, yes.

(4) Where did they "Pitch Mac"? Why did the "Rag bolt," and where? What made the "Rock drill"? What made the "Sand blast"? and did it "Blast Furnace Slag"?

On the centre, on the haunches, in the water channel. The rag bolted because the hand pitched and the boaster was sharp. The drill was good temper. He saw the sparrow picking. Yes, although I prefer to mac a dam.

(5) What is the "affinity" between Poly Cycle and Anne Thracine, or is there no "bond"?

Procure a monkey and guy, well pun.

(6) Why is it necessary to give a road a "stocking," and has this anything to do with the "toe" of an embankment? Does the word "topping" apply in this case?

Possibly the carriageway was also a footway, the toe of the embankment is presumed to adjoin the footpath. The word "side" is preferable to "topping."

(7) Does the expression "corduroy" apply to the "carpet" or the surveyor's breeks?

One covers the surface, the other the bottom. Whose avenue?

(8) What did the bard say when it saw the "stone dressing"? [Note.—The following obvious answers are disallowed: (1) "Axe" me. (2) You *are* a "free stone."]

Plain face, rusticated margins, sharp angles, wanted a screen.

(9) When is a "hanging road" on its "haunches," and should it be "scarified," or would "racking" meet the case?

On a long stretch it would be on the verge of a vacuum and should be well battered.

(10) What is the difference between sentiment, "centimetre," and "sediment"? and is the "Dandy" always "siding"?

All experts hold that this is a case for Cofferdam.

The "candidate" put the following cryptic signatures at the end of his answers:—

AMBITION—M.I.C.E.
RESULT—R.A.T.S.

Pup. to B.S.,
Bedlam.

Pudlo as a Waterproofing Medium.—The architects for the Middleton sanatorium have adopted the powder Pudlo for the waterproofing medium, and in addition have specified its use in a large training college.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Oadby U.D.C. (August 27th. Mr. A. W. Brightmore).—£4,600 for the extension of the sewage disposal works. It was explained that some years ago a scheme was prepared for sewering the Wigston-road district, and it was submitted to the Local Government Board, who stated that they were not prepared to sanction a loan for the execution of the works until defective conditions on the sewage works had been remedied. In July, 1914, it was reported that the present system for the disposal of sewage—broad irrigation—was unsuitable owing to the nature of the soil, and the adoption of a system of filtration by means of artificial filters was recommended. A scheme was prepared by the council's surveyor (Mr. W. Bell) and Mr. E. G. Mawbey, M.INST.C.E., the borough engineer of Leicester, acting as consulting engineer, to deal with the sewage by means of percolating filters, and ultimately the council unanimously approved of it. In preparing the scheme attention had been paid to the probable growth of the district. There appeared to be a difference of opinion in regard to the probable growth of Oadby as a manufacturing centre, owing to lack of railway facilities, but plans had recently been passed for a factory which might employ up to 200 hands. The sewering of the portion of the Wigston-road had been included in the scheme. The council unanimously approved of the scheme, but under the special circumstances in which the country was placed they thought it would be advisable to request that the execution of the works be postponed until after the war. Evidence was given by the surveyor, Mr. E. G. Mawbey, Dr. O'Connor, and Mr. H. Sturgess Wells.

St. Helens T.C. (August 26th. Mr. A. W. Brightmore).—£15,000 for the extension of the electricity works and the provision of additional plant. It was stated that the application was rendered necessary by the increased demand for energy by various firms in the town who were engaged in war work. The original estimate was £14,000, but owing to the increase in the price of materials they had to ask for £15,000. The electrical engineer said they hoped that some of the works in the district would benefit after the war by capturing German trade, and that they might have many successful years before them. Councillor Francis, a member of the Electricity Committee, said it was eminently necessary that the expenditure should be incurred, as there was no other way out of the difficulty.

Skelmersdale U.D.C. (September 1st. Mr. F. H. Tulloch).—£2,000 for the provision of a new gasholder and condenser.—In the course of the inquiry the inspector said he was there to squeeze the council down to the last farthing, and asked for minimum requirements. The clerk, Mr. A. Dickinson, pointed out that the township had been plunged into darkness several times, but the inspector replied that in abnormal times the council must take such risks. Eventually a modified scheme pressed for by the inspector at less than half the original cost was submitted by the council's gas engineer.

APPLICATION FOR LOAN.

Ipswich T.C.—£8,750 for sub-stations in connection with the electricity undertaking.

LOANS REFUSED.

Cork T.C.—£7,894 for asphalting pavements, and £950 for concreting the beds of streams.

Louth C.C.—A letter has been received from the Local Government Board declining their sanction to a loan of £10,000 for the building of new county offices. The council had arranged for the loan from their bankers at 3 per cent under an old agreement.

Rothwell U.D.C.—£2,250 for a supplemental water supply.

Westhampnett R.D.C.—£4,000 for works of sewerage.

FORTHCOMING INQUIRIES.

SEPTEMBER.	£
14.—**Wembley.** For sewage works extension (Mr. A. W. Brightmore)	12,071
TOWN PLANNING.	
9.—**Grimsby.** (Mr. George L. Pepler) ...	—
15.—**Leeds.** (Mr. George L. Pepler) ...	—

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Acton, Llanelly; housing and town planning—Herts; refuse disposal—Sheerness; water, gas and electricity—Chorley, Rothbury. Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Acton U.D.C. The council have approved the plans of the engineer, Mr. F. Sadler, for the extension of the fire brigade station.

Barnet U.D.C. Plans have been approved for public conveniences in Albert-road.

Leek R.D.C.—A tender at £530 has been accepted for building a temporary isolation hospital at Tinster's Wood.

Llanelly and Llandovery R.D.C.—It has been decided to build a bridge at Glanrhyd to replace the one destroyed by a flood.

Monmouthshire C.C.—A new council school at Tynywern, Tre-Thomas, built for the Education Committee, has been formally opened. The plans were prepared by Mr. J. Bain, architect to the committee, and the cost was £10,500.

Roscommon C.C.—Plans were recently submitted for a tuberculosis dispensary, at £1,200. The county surveyor, Mr. C. Mulvaney, also prepared a scheme the estimated cost of which was £1,400. It was explained that only £1,000 had been allowed for the erection of the building, and Sir Acheson M'Cullagh stated that the Local Government Board had specimen plans for buildings at £650 and £1,000. Mr. Mulvaney said that no permanent building could be erected at less than he had estimated. He would not advise the council to spend the ratepayers' money on a building of tin and sticks. It was decided to forward the county surveyor's plans to the Local Government Board.

HOUSING AND TOWN PLANNING.

Fermoy U.D.C. A second instalment of the loan of £1,000 for the erection of cottages has been received from the Local Government Board.

Herts C.C.—The Housing Committee have approved provisionally of plans for 100 cottages at Letchworth to house the Belgian refugees. The price is from £175 to £240 per cottage.

Lanarkshire C.C.—The Middle Ward District Committee have decided to make application to the Local Government Board for authority to prepare a town planning scheme in respect of land lying within the parishes of Cambuslang and Old Monkland. The extent of the area included in the scheme is about 5,616 acres.

Omagh R.D.C. A letter has been received from the Local Government Board impressing on the council that it was absolutely essential that during the present crisis the issue of further instalments of the loan of £21,930 under the Labourers Act should be curtailed, and that with this end in view the erection of as many of the outstanding cottages as possible must be deferred until the termination of the war. Before proceeding to enter into any further contracts or inviting tenders for the erection of cottages which the council might consider as urgently required for the replacement of condemned dwellings, the council should first of all obtain the board's approval.

Rawmarsh U.D.C.—The Sanitary Committee recommend the council to take up the matter of the purchase of land for housing purposes.

Stainland U.D.C.—The council are being urged by the West Riding County Council to proceed with a housing scheme, it being pointed out that there is a shortage of five-roomed houses in the rural district.

Strood R.D.C.—Negotiations are in progress for the erection of fifty cottages for Government workers.

REFUSE COLLECTION AND DISPOSAL.

Dublin T.C.—The Cleansing Committee have issued a report, in the course of which it is stated that the carrying out of the Order in Council reducing the hours of the men to fifty hours per week, without any provision for additional men to make up the time lost, will have a very serious effect on the working of the department. Meantime the committee have put the Order into effect, but at a serious loss in efficiency. The Estates and Finance Committee reported to the council in connection with the estimates this year, and they had been obliged to strike out a sum of £2,800, which had been included by the Cleansing Committee to enable them to bring their staff up to its normal standard. The work had, accordingly, to be considerably curtailed, and the further curtailing which has now to be put in operation will seriously affect both the street cleansing and watering and the dust-bin collection.

Haltwhistle R.D.C.—The council have approved a recommendation of the Sanitary Committee to give public notice that ashpits in which refuse (such as old pieces of oilcloth and old bags) other than house refuse was deposited would not be cleansed by the contractor.

Sheerness U.D.C.—A letter has been received from the Local Government Board intimating that the council's application for a loan of £5,000 for the enlargement of the refuse destructor was generally satisfactory, but that under present circumstances the loan could not be sanctioned. The council have regarded the enlargement of the destructor as part of the water supply scheme, the existing boiler being required for the air-compressing plant to be installed at the supplementary borehole at Sheerness East, which is to be the third source of supply, and has been proved equal to a capacity of 12,000 gallons per hour. In the circumstances it has been decided to once more approach the Local Government Board with a view to laying these facts before them.

ROADS AND MATERIALS.

Bath R.D.C.—It has been decided to call the attention of the county council to the condition of the London-road, as well as to the report of the rural council's surveyor last year, in which he urged that the road should be treated with Tarmac.

Dunbar T.C.—The scheme for the improvement of Westgate-road by the widening of the roadway and the removal of sharp corners has been completed recently, at a cost of between £1,800 and £2,000. Part of the ground for widening was given by the War Office.

Dundee T.C.—It has been agreed by the Works Committee to make up Kerrington-crescent, Barnhill.

Ilford U.D.C.—An intimation has been received from the Essex County Council that the County Highways Committee had once more adjourned consideration of the widening of Ilford hill.

Mayfield R.D.C.—The tender of the Lancashire Road Roller Company has been accepted for the hire of a steam roller, at 24s. per day, including driver and fuel.

Perth T.C.—The Paving Committee are considering a scheme for the improvement of Glasgow-road between the entrance to the joint railway station and Earle's Dykes.

Saddleworth (Yorks) U.D.C.—At the meeting recently of the Highways Committee, Councillor Hudson called attention to the bad state of the Delph district roads. He remarked that something would have to be done in the matter. It would be seen from the monthly accounts that only £7 had been spent on the 17 miles of district roads in the ward. They were full of ruts, in some places 8 in. deep, and he knew folk who were afraid to traverse them at night owing to the dangerous state in which they were. He instanced the road leading over Hill End to New Delph, the road past the council houses, and that leading up to Stoneswood. The present policy was "penny wise and pound foolish." If some of the men stopped sweeping on the main roads and were put on to repair the districts roads it would be much better. The chairman agreed that far more attention was being paid to main roads than to district roads. Councillor Moorhouse suggested that a few more men might be engaged if there were insufficient council labour.

St. Germans R.D.C.—With respect to a complaint by the county surveyor, Mr. L. D. Thompson, as to

the quality of the stone supplied, from Viverdon quarry, a committee, consisting of the rural surveyor, Mr. K. J. Foster, and several councillors, has been appointed to meet the county surveyor for the purpose of going into the matter.

SEWERAGE AND SEWAGE DISPOSAL.

Bradford T.C.—It was announced on Wednesday at the meeting of the council that the Local Government Board had declined to sanction any further loan in connection with the Esholt tunnel scheme. The purpose of the tunnel, which is to be nearly 3 miles long, is to pierce a hill with a view to conveying the sewage of the city to the new sewage works at Esholt. The contract, which is for well over £100,000, was let last year to Messrs. Best & Sons, Limited, and a good deal of the preliminary work has been done. The Sewage Committee consider the matter so serious that it has been decided to send a deputation to the Local Government Board with a view to permission being obtained to proceed with the work.

Bury T.C.—The cost of sewage treatment last year, the sewage works manager reports, was £3 0s. 8d. per 1,000,000 gallons, against £2 16s. 7d. the previous year. The cost per head of population was 15·23d., against 12·69d.

Chertsey R.D.C.—The surveyor, Mr. H. Beeney, has received instructions to report upon certain ditches in Byfleet, with respect to which complaint has been made.

Halsted R.D.C.—A sewerage scheme for Castle Hedingham has been prepared by Messrs. Taylor & Wallin, engineers, Newcastle-on-Tyne, the cost of which is estimated at £3,981.

Lichfield R.D.C.—It has been agreed to take up a further loan of £800 for sewerage and sewage disposal works at Hammerwich.

Wantage R.D.C.—A scheme has been approved for the sewerage of Harwell. A system of land treatment will be adopted, and the storm water will be separated from the sewage. The existing sewers will be made use of for surface water.

WATER, GAS, AND ELECTRICITY.

Batley T.C.—It has been decided to increase the price of water supplied by meter from 8d. to 9d. per 1,000 gallons as from October 1st next.

Chorley T.C.—A resolution has been adopted asking the sanction of the Local Government Board to proceed with the scheme for the extension of the gasworks.

Dromore R.D.C.—The council's engineer has received instructions to prepare a scheme for improvements at the Enniscrone waterworks.

Hull T.C.—A letter has been received by the Water Committee from the Local Government Board stating that they had had under consideration the report of their inspector (Mr. Fawcett), and the amounts sanctioned for the construction of certain waterworks. These make a total of about £56,000, and, as regards the Dunswell works, amounting to £14,000, the board say that these should be stopped at once except as to any lining required to make the well usable by means of temporary pumping plant. "The existing sources," it is added, "can, with care, be made to suffice for some time to come." The matter was referred to the chairman, deputy chairman, town clerk, and water engineer, giving them full power to order the contractors to stop the works, and to take any further steps that might be advisable; also to report to the full committee. The action of the Treasury will not affect the work in progress for taking Hull water to Withernsea. This scheme is practically completed.

Manchester T.C.—An electric light installation is to be provided at Bagulay sanatorium at a cost of £651.

Rothbury U.D.C.—The council have instructed Messrs. D. Balfour & Son, of Newcastle-on-Tyne, to prepare a report on the water supply and works.

MISCELLANEOUS.

Ashton-under-Lyne T.C.—The question of providing a motor fire engine is being considered by the town council.

Plymouth T.C.—Six new tramcars, purchased at a cost of £1,800, have been put into service this week. They were designed by Mr. C. R. Everson, general manager of the corporation tramways, and were built by the Brush Electrical Company, Loughborough, with electrical equipment by the Westinghouse Company, Manchester.

PERSONAL.

Mr. James Cecil Monk, of Eccles fire brigade, has been appointed deputy fire superintendent of Bootle.

Mr. J. Humphreys, surveyor to the Machynlleth Urban District Council, has been voted an increase of salary.

Mr. E. R. C. Harvey, second sanitary inspector to the St. Austell Rural District Council, has joined the R.A.M.C.

Mr. Robert H. Hampton, of the Doncaster borough surveyor's department, has been gazetted Second Lieutenant in the Royal Engineers.

Mr. J. S. Williams, Denbigh, has been appointed assistant to the county surveyor for main roads for the Western Division of Denbighshire.

Mr. Reginald J. Samuel, B.SC., ASSOC.M.INST.C.E., of the Road Board engineering staff, has been gazetted Lieutenant in the Royal Engineers, and is now on duty with the 6th Labour Battalion of that regiment.

Dr. S. S. Rendall, medical officer of health to the Boston Rural District Council, has joined the R.A.M.C., and his duties will be discharged in his absence by Dr. Arthur Tuxford, the late medical officer.

Mr. Arthur O. Callear, engineer to the Madeley and Broseley Joint Water Board (borough of Wenlock), has been appointed surveyor to the Madeley District Council of the borough at a salary of £205 per annum.

The marriage arranged between Lieutenant P. Hubert Boulnois, R.N., and Miss Lucy Boase will take place on Tuesday next, in the Catholic Apostolic Church, Dundee, at 2.30. Lieutenant Boulnois, who is in command of a submarine "somewhere off the coast of England," is a son of Mr. H. Percy Boulnois, M.INST.C.E. Owing to the war, no invitations will be sent, but friends able to be present will be welcome.

An interesting wedding took place on Tuesday last at St. Mary's Church, Stone, Kent, the bridegroom being Mr. J. P. Killick, ASSOC.M.INST.C.E., county surveyor of Hertfordshire, and Miss Lizzie Sheldon Maybury, daughter of Mr. H. P. Maybury, M.INST.C.E., chief engineer and manager to H.M. Road Board. The bride was given away by her father, and Mr E. B. Went, of the Road Board, attended the bridegroom as best man. A reception was subsequently held at Barnesfield, Greenhithe, the guests including Lady Gibb, Mr. W. F. Mannelle, Mr. and Mrs. H. T. Chapman, Mr. and Mrs. A. Dryland, Mr., Mrs. and Miss Willmott, Mr. H. Howard Humphreys, Major S. Stallard, Mr. and Mrs. T. Bowes, Mr., Mrs. and Miss Rees Jeffreys, Mr. and Mrs. Peter Dodd, Mr. and Mrs. Percy Sheldon, Mr. H. Percy Boulnois, and Colonel R. E. Crompton.

SURREY COUNTY SURVEYOR'S DEPARTMENT.

The Surrey Highway Committee have reported that the staff of the county surveyor's department consists of the surveyor, assistant surveyor, engineering assistant and draughtsman, and four office clerks, one of whom is on active service, and the salaries paid total £2,050. The duties of the department relate chiefly to the maintenance of 223 miles of main roads, of which 197¼ miles are contracted for by twenty-nine local authorities, and 25¾ miles are under the direct control of the county council. There are also a large number of assisted roads, county and other bridges, and an immense amount of detail work is involved. After setting forth this work in some detail, the Highway Committee adds—

"The work of this department has been greatly added to in recent years by the altered character of the work of road maintenance, the establishment of the Road Board, and lately by the large undertaking of reconstruction work on the east side of the county. The staff has always been barely adequate for the work, and is not sufficiently equipped now for such detailed analysis of costs and accounts as is really desirable to ensure the utmost economy. A good accountant clerk is badly needed. The staff is always working under pressure, and a good deal of overtime is worked, particularly for some weeks after the close of the financial year."

OBITUARY.

Trooper P. Fenn, Warwickshire Yeomanry, formerly clerk to the city surveyor of Lichfield, has, we regret to state, been killed in action.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not to be hoped that Mr. Hamilton's experiment at Glasgow in the erection of small houses in which electricity is to furnish means of lighting, heating and cooking will prove a success? Does he not show by figures that such a method makes it possible to save domestic labour, and that with electricity at ·77d. per unit a real economy can be effected? When in addition to this the fact of cleanliness and other advantages are taken into account, is it not quite possible that, with a modicum of care and economy, such houses may be found to be the house of the future?

* * * *

Was it not rather courageous of the Scarborough Town Council to complete the construction of a bathing pool on the foreshore, at a cost of £5,000, when the bombardment by the Germans of this well-known watering-place took place only a few months ago? Does it not speak highly for the activities of our "silent fleet" that the administrators of this popular seaside resort should now feel so safe that they are not afraid to carry on "business as usual" in order to attract visitors?

* * * *

Is there anything wrong in the methods employed in Fifeshire for tar-painting the surface of the roads in that county? One would like to know if there were any grounds for the complaint of a member of the Dunfermline District Committee that these roads were in a dangerous state owing to their slippery condition? Why is it that complaints of this description are frequent in some counties when in the majority of counties one hears nothing but praise of this method of treating road surfaces?

* * * *

Is not the proposal of the Wilts County Council with regard to the remuneration of the assistant surveyors in connection with their supervision of repair of main roads requisitioned by the military authorities, as given in the issue of The Surveyor of August 20th, rather remarkable finance? Does it not appear therefrom that, instead of giving these surveyors a salary, the percentage is so fixed that, whatever happens, whether £10,000 or £40,000 is spent on the roads, the surveyor gets £200? Why could this not have been fixed instead of entering into a complicated agreement, which comes to exactly the same thing as £200 a year, unless, which is very unlikely, more than £40,000 is spent, when the surveyor would get ½ per cent on the expenditure above this amount?

* * * *

Would it not be interesting to know decisively whether—(*a*) It is cheaper and better to spray tar on the surface of a road by machine or by hand? (*b*) It is cheaper and better to spread chippings on the surface of a road by means of a spreading machine or by hand? (*c*) Whether sand, pea gravel, or stone chippings are the best to spread on the surface of a road after the surface has been tarred; or is it better to leave it alone? Is it not to be hoped that some trials will be made by some independent body or person, when the war is over, to try and settle these points?

* * * *

What are the names of the architects who sent in schemes in competition for the working-class dwellings to be erected by the Kingstown (Ireland) Urban District Council? What will the Royal Institute of British Architects say, or do, with regard to these gentlemen, after asking their members not to send in any schemes, as the terms offered by the district council did not comply with the wishes of the institute? Are there not, however, a large number of architects who are not members of the institute?

* * * *

Are there any authentic instances of explosions in sewers due to gases generated in the sewage itself? Have not nearly all such explosions been traced to the escape of coal gas through an adjoining street gas main or service? Will it not be interesting to hear the result of the inquiry, if any is to be made, as to the recent explosion in the sewers in Aldershot?

A Doncaster Town Planning Scheme.—The Doncaster Town Council on Wednesday received notice from the Doncaster Rural District Council of their intention to apply to the Local Government Board for sanction to a town planning scheme for Armthorpe and Kirk Sandall. The Estates Committee were instructed to consider the matter.

ARCHITECTS' AND QUANTITY SURVEYORS' REMUNERATION.

SURREY COMMITTEE'S REPORT.

The payments to architects and quantity surveyors, and the cost of the surveyor's department of the Education Committee of the Surrey County Council have repeatedly given rise to adverse criticism, and the county council in March last called for special consideration and report on the matter. In their report the sub-committee deal with it at great length. It seems that for the ten years ending 1914 the total certificates for elementary schools issued by the architects amounted to £346,752, their commission for the first year being £750 and for the subsequent nine years £1,200 a year, which works out at an average of 3·3 per cent. Higher education work has been paid for at the rate of 5 per cent. Travelling and out-of-pocket expenses have also been paid, varying from £63 to £100 a year. The sub-committee have carefully considered the two alternatives to the present arrangement—viz., the employment of a number of selected architects, or the appointment of a whole-time architect to the committee, and give good reasons for coming to the conclusion that the present arrangement is both more satisfactory and more economical.

The method of remuneration of the quantity surveyor is explained, his commission being 2 per cent on alterations up to £1,000, 1½ per cent an alterations or new schools up to £10,000, and 1 per cent beyond that sum. This has proved economical and satisfactory to the Education Committee, but the quantity surveyor himself is asking for a revision of the terms. Much space is given to the surveyor's department, which has come under adverse criticism at meetings of the county council. The cost of the department is somewhere about £2,000 a year, excluding the salaries of clerks of works, which by an ingenious method of calculation based on the rental "value of the property for which the committee is directly or indirectly responsible," is shown to work out at 2·7 per cent of the annual rental, and the "sub-committee find no evidence that the cost of the surveyor's department has been excessive."

FOR OTHER ADVERTISEMENTS
See End of Paper.

TEDDINGTON URBAN DISTRICT COUNCIL
HEATING APPARATUS.

Tenders are invited for the installation of a small Hot-water Heating Apparatus in the Fire Station, Waldegrave-road, Teddington.

Plans and Specification may be seen at the Surveyor's Office.

Tenders, endorsed "Tenders for Heating," to be delivered to me not later than noon on Monday, 13th September, 1915.

G. H. SALMONS,
Clerk.

Public Offices,
Teddington.
September 2, 1915. (2,710)

ANNUAL CONTRACTS.

LEATHERHEAD URBAN DISTRICT COUNCIL.

The above Council invite Tenders for the undermentioned Materials and Work for the year ending September 30th, 1916:—

Broken Granite.
Team Labour.
Artificial Stone.
Disinfectants.
Brooms.
Paraffin Oil.
Steam Rolling and Scarifying.
Forage (for three months).

Specifications and Forms of Tender can be obtained at the office of the undersigned

Tenders to be sealed and delivered to me by 5 p.m. on Tuesday, September 14th, endorsed "Tender for ....."

The Council do not bind themselves to accept the lowest or any Tender.

SIDNEY R. DRAKE,
Surveyor.

Council Offices, Leatherhead.
September 1, 1915. (2,709)

Institution of Municipal and County Engineers.

EASTERN SUB-DISTRICT MEETING AT CROMER.

(Conclusion.)

Following the proceedings reported in last week's issue, the subjoined paper was submitted for consideration at the recent Eastern Sub-District meeting of the Institution of Municipal and County Engineers at Cromer.

ROAD TARRING.

By R. CROOME,
Surveyor to the Cromer Urban District Council.

I admit road tarring is a subject which is almost worked to death, and probably nothing new can be said about it. Cromer is practically tarred from end to end. This is not because the Cromer councillors are all shareholders in the gas company, but because, after nine years' experience, we have proved its value for road maintenance.

At one time Cromer roads were all made up with broken flints from the beach, but many years ago granite was substituted on all main roads. Now ordinary granite roads are found unsuitable to withstand the traffic. Cromer main roads, especially for four months in the year, are subject to a considerable motor traffic—chiefly private cars, but a motor-'bus service of twenty-five cars a day is run along the coast road.

A common error in road making is to imagine that because a success has been made of some particular method in one district, all roads should be made exactly the same. For instance, Mr. Brodie, of Blackpool, at the annual meeting in London, objected most strongly to the use of local stone. In Cromer we find that local beach flints, broken, make good material for our secondary roads, and I should not care to recommend the council to substitute granite at 14s. 7d. a ton on the road for flints at 5s. 8d. for such roads. Local experience is the great factor in road making, as hardly any two districts have exactly similar circumstances to contend with.

Probably tar-macadam as laid round the churchyard would be the best road material in this district on all main roads; but we are immediately up against cost, and while, for instance, Mr. Brodie would ignore first cost, ordinary surveyors cannot do so. Unfortunately, while surveyors can lay most excellent theoretical roads at London congresses, when at home they have to lay practical roads. Thus, in Cromer we find tar-painting in every way an ideal substitute for tar-macadam.

Our president said at the National Road Conference, "Many people thought the tar-painting of roads was a very simple matter, and that ordinary sand or beach shingle or road grit or scrapings was going to make a tar-painted surface last a considerable time." I quite agree that such tarring on the Great North Road in Middlesex would be useless, but I certainly say in this district it is not so, as I will try to prove. In Cromer we break every theoretical method of road tarring, and, if I may say so, we do the work in the most primitive way.

What do we do?

First, the road must be in a good condition; this is essential.

Then the road must be dry.

The road is thoroughly brushed by hand.

The tar is direct from the local gasworks, and untreated.

It is boiled in a 50-gallon tar-boiler, put on the road from buckets, and spread with squeegees.

It is at once covered with sand from the beach, cliffs, or local pits.

All surplus sand is swept off in a day or so, and re-used on other roads. Should, however, there be much wind in the interval, the surplus sand is generally blown away, the adjoining resident ratepayers getting rather more than they want through their doors and windows.

The costs of our materials are as follows: Tar, 2¾d. a gallon at works; labour, 4½d. an hour, one man 6d.; sand, 2s. 6d. per load on road.

The cost per super. yard last year was as follows (I ought to say the cost includes everything except a charge for hire of boiler and use of squeegees, brushes and buckets):—

Runton-road.—Area, 6,359 yds. super., tar-painted surface of previous year in good condition, ·42d. per super. yard.

Overstrand-road. Area, 4,825 yds. super., tar painted surface of previous year in fair condition, ·72d. per super. yard.

Overstrand-road.—Area, 1,350 yds. super., surface not previously tar-painted, 1·11d. per super. yard.

Norwich-road.—Area, 3,058 yds. super., tar-painted surface of previous year in centre of roadway nearly gone, ·59d. per super. yard.

Holt-road.—Area, 4,491 yds. super., tar-painted surface of previous year in good condition, ·46d. per super. yard.

I may add that when patching was required before tarring the labour was, unfortunately, not kept separate, and is included in the cost of tar-painting; also, as tarring must be completed before the season, it is done in April and May, when the weather is often most unfavourable. A combination of these two adverse factors was the reason for Overstrand-road costing more than the others.

The roads I have referred to are all main roads with a granite surface, but we find our flint roads when tarred are equally successful.

The cost on previously treated roads works out to less than ½d. per super. yard, taking the whole of the flint roads tar-painted in the district. A road that was made up and treated for the first time cost ·86d. per super. yard.

I have worked out the cost of maintenance of several sections of the Runton main road, and the following particulars, showing the saving in maintenance due to tar-painting, may be of interest:—

Portion A, length 320 yds.

	s.	d.
Coated in granite 1906; cost per super. yard	1	2
Repaired in granite 1913; cost per super. yard	0	9
Coated in granite 1914; cost per super yard	1	2
Tar-painted 1909, 10 and 11; cost per super. yard	0	2
Cost of patching and repairs not ascertained	—	
	3	3

Cost per super. yard per annum, 4·88d., or allow the road will not require recoating again till 1916, 4·09d.

Portion B, length 120 yds.

	s.	d.
Coated in granite, 1904; cost per super. yard	1	2
Coated in granite, 1909; cost per super. yard	1	2
Tar-painted, 1909, 10, 11; cost per super. yard	0	2
Cost of patching and repairs not ascertained	—	
	2	6

Cost per super. yard per annum, 3d.
This portion will need recoating before the end of the year.

Portion C, length 90 yds.

	s.	d.
Coated in granite, 1904, cost per super yard	1	2
Tar-painted each year since 1907	0	4
Practically no patching or repairs since ..	—	
	1	6

Cost per super. yard per annum, 1·8d.
This portion is still in good condition.

Portion D on plan, length 185 yds.

This was coated last in 1902, has been tar-painted annually since 1907, and is now in an excellent condition. It is true the road here is much wider, but the traffic is much heavier, adjoining the town as it does, with various additional streets opening into it; also a much-used cab stand extends over half its length.

In addition to the decrease in cost of maintenance, I need hardly remind you that the following saving is also effected:

(1) The whole of the watering.

(2) Less and easier scavenging.

(3) Less skirting—in fact, where the roads have kerbs, none at all, when previously weeding had to be done twice a year.

(4) Heavy rains do no damage to the roads.

The advantage of a tar-painted surface for the comfort of the users of a road, over an ordinary macadam road especially if of flints, need hardly be referred to, as it is so apparent.

Tar also does completely away with that terror of road users and surveyors namely, a flint road in dry weather.

Now, urban districts in Norfolk have many grievances. I must refer to one which is without doubt a genuine one.

The Norfolk County Council will allow only three-fourths the cost of tar-painting their main roads. The cost of tarring the 18,733 super. yds. of main roads which had been treated in previous years amounted to ·54d. per super. yard. Assuming a saving in maintenance on this area of only a 1d. per super. yard, the total saving would amount to £78 each year. As a matter of fact, I have already given figures proving that a much larger sum has actually been saved.

Take a length of road 1 mile long by 6 yds. wide. If this were tar-painted annually the saving to the county council would be:—

	£
Saving in maintenance at 1d. per super. yard	44
Saving in watering	10
	54

(Exclusive of less skirting, patching and scavenging.)

The amount allowed by the county for tarring this area of road would be:—

	£	s.	d.
Full cost of tarring at 9d. per super. yard	22	0	0
Less fourth paid by urban council, £5 10s. 0d.			
Less £10 a mile for watering, 10 0s. 0d.			
	15	10	0
	6	10	0

The result is that, for a cost to them of £6 10s., the county saves £44 per mile at least. The district council are called upon to contribute the sum of £5 10s. a mile in order that this saving may be effected by the county council. It is hardly surprising that under the circumstances the district council have declined to tar-paint the greater part of the main roads within their district.

A portion of Runton-road, right up to our boundary, has been tar-painted at the entire cost of the county; another portion adjoining it, and just inside our boundary, has not been treated, simply because the county will only pay three-fourths the cost. The road in both cases is of an absolutely rural character—no houses—and the only thing to denote the difference in its character is the boundary post.

If it is economical for the maintenance of the road to tar it on one side the boundary post, the same applies on the other side. If the Norfolk County Council will not pay the whole cost, a fairer way would be to allow a certain sum per yard, as is done in Middlesex, Dorset, Leicester and other counties. But my point is that they should pay the lot, as Hereford, Essex, Nottingham, Derby and many other counties do.

DISCUSSION OF MR. CROOME'S PAPER.

Mr. Julian Julian (Cambridge) wrote: Although I shall not be able to be present at the meeting, I send a few figures and notes as to road tarring in Cambridge. The first year we did any tarring with our own horse-drawn machine was in 1909, previous to which we had either tarred roads by hand or had the work done by contract. Until this year crude tar has been used for the bulk of the work, and only small experimental areas with other material. This year we have used dehydrated tar, which has not only cost more per gallon, but has covered less area. The cost per square yard are given in tabulated form for 1909, 1914, and 1915. They include the preliminary sweeping by machine broom and by hand. The daily rates of wages and haulage have gone up between 1909 and 1915, but the difference in cost of sand, &c., is chiefly due to more gritting material being used, although a part of the increase is due to some slag and granite chippings being used instead of sand only.

Road Tarring in Cambridge

Particulars.	Pence per sq. yd.		
	1909.	1914.	1915.
Wages	0·073	0·081	0·092
Haulage	0·064	0·066	0·093
Tar, &c. ..	0·263	0·370	0·524
Sand and chippings	0·058	0·145	0·184
Coke, oil, &c.	0·008	0·007	0·006
Total	0·466	0·669	0·899
Square yards covered by 1 gallon of tar ...	7·61	7·51	5·73
Cost of tar per gallon .	2d.	2½d.	3d.

Mr. W. Starkie (Welton Rural) wrote: I forward herewith a few particulars relating to road tarring in this district. In 1913 the area sprayed was as follows: Main roads, 20,040 sq. yds.; district roads, 64,463 sq. yds.; total, 84,503 sq. yds., at a cost of £189 8s. 6d.—main roads £46 12s. 5d., and district roads £142 16s. 1d. The cost per square yard was ·55d. In this case no chips of any kind were used. The road was well swept, and after being tarred the dust was brushed back again. The result was, complaints from motorists and others of the road being insufficiently dusted. Considerable increase will be noticed in the area sprayed in 1914, the figures being: Main roads, 36,261 sq. yds.; district roads, 86,156 sq. yds.; total, 122,417 sq. yds., at a total cost of £316 17s. 5d. (main roads £93 7s. 4d., and district roads £223 10s. 1d.). The cost per square yard was ·62d. Altogether some 12,945 gallons of tar were used, 1 gallon spraying about 9 sq. yds. In 1913 and 1914 ordinary gas tar, at 2½d. per gallon, was used. The increase in cost per square yard—·62d. for 1914 and ·55d. for 1913—may be accounted for by the fact that during 1914 the whole of the area tar-sprayed was well covered with slag chips and dust, which is, I think, as good as anything that can be found. The figures for this season—1915—are: Main roads, 23,313 sq. yds.; district roads, 46,462 sq. yds., at a total cost of £202 1s. (main roads £78 5s. 2d., and district roads £123 15s. 10d.). Cost per square yard, approximately, ·70d. Under normal conditions a much larger area would have been sprayed in 1915 than in the previous year, but the question of economy, consequent upon the war, compelled a considerable reduction in the expenditure upon tar-spraying, as also upon other matters. This year distilled tar was used, costing at the works 37s. 6d. per ton. Adding to this the cost of carting from gasworks to station, and railway carriage to the respective stations in the district, the cost per gallon for distilled tar worked out at about 3¼d. per gallon. Slag chips and dust were also used. The whole of the work of tar-spraying is carried out by direct labour. The machine used is one of about 80 gallons capacity supplied by Messrs. Llewellin & James, of Bristol. Usually a gang of nine or ten men are employed, the same men going from village to village. There is a great advantage in keeping the same men with the machine throughout the season, thus avoiding having to rely upon men who are strange to the work. Of the wisdom of tar-spraying there can, I think, be no doubt. It is generally agreed that, from whatever point of view it may be regarded, tar-spraying is beneficial. Particularly is this the case in villages. We can, in this district, cover from side to side (slag sides and granite centre) and steam roll a section of road for about 1s. 4d. per square yard. This is, of course, by the ordinary water-bound method. By using "Vianex," mixed with slag chips and dust, as a binder, a new section can be laid for about 1s. 8d. per square yard. Add to each of these prices 1d. per square yard for tar-spraying, and an excellent macadam road can be made, quite suitable for most rural districts, at a cost of 1s. 5d. and 1s. 9d. per square yard respectively. Apart from the benefit derived to the road by tar-spraying, it is generally appreciated by the public, because they feel that it does, in some measure at least, solve the dust problem.

Mr. H. Collins (Colchester), in proposing a vote of thanks to Mr. Croome, said he would like to give a few details of work he had carried out during the present year. He had tar-painted an area of 198,000 sq. yds. at a total cost of £1,314. Of refined tar he had used 14,151 gallons at a cost of 1·166d. per yard, and of crude tar 24,840 gallons at a cost of 3d. per yard, the average cost of the 38,994 gallons thus being 3·26d. per gallon. The cost of the tar was £521. Five yards were covered with every gallon of tar. He spent £349 18s. 5d. on 1,019 cube yards of siftings—an average cost of 6s. 10½d. The detailed costs per super. yard of work were: Tar, ·642d.; manual and team labour, preparing road, removing dust, spreading and handling tar, ·307d.; siftings, ·424d.; cartage and spreading of siftings, ·101d.—a total cost per super. yard of 1·474d., or, allowing ·076d. for maintenance and depreciation of plant, and replacements, 1·550d. The Road Board had agreed to pay for the extra cost of refining tar above ½d. per gallon. His own experience had been that it was no use using sand where the traffic was at all heavy. Apart from granite chippings he had found crushed flints the best

material. He could speak from experience of the efficacy of tar treatment as a protection against damage to roads in times of floods; in Norwich flood water passing across a road had stripped off the untreated parts, but had failed to touch the tarred portions. In carrying out tarring work his practice was to put a broom over the surface first, and he had found a Waithman broom suitable for use with refined tar. As at Cromer, many of his roads were subjected to very heavy military traffic during last winter, and they made application to the military authorities and to the Road Board for grants towards the repair of the highways affected. As they would know, the Road Board acted as agents for the War Office in these matters, and he was able to come to quite a satisfactory arrangement with the board, getting a grant of £850, and a loan of £500 as well, free of interest. What the board did was to deduct an amount proportionate to the ordinary wear.

Mr. F. HALL SMITH (Sheringham) stated that his experience of tarring flint roads had not been satisfactory. Flint was practically non-absorbent. Granite absorbed a certain amount, but flint did not.

Mr. COLLINS remarked that he saved a flint road last year by tarring. As the road was getting very loose, he decided to tar it, and it was still in good condition, though he admitted he tarred it again this year.

Mr. G. W. LINGWOOD (Stowmarket) mentioned that he treated an area of 2,574 sq. yds. of granite road with refined tar bought at 3⅜d. per gallon, the cost working out at 1·857d. per yard. On an adjoining area of 2,051 sq. yds. of flint road he used crude gas tar, and the cost was 1⅞d. per yard. On another length, a granite surface of 2,919 sq. yds., using crude tar, the cost was $\frac{7}{10}$d. per yard.

Mr. E. H. ESSEX (Leyton) said he desired to emphasise the importance of the tabulation of statistics, by which he meant the presentation of these in a scientific way. As illustrating his meaning, Mr. Essex submitted the appended table showing the comparative annual cost in his district per square yard of various classes of paving:—

Class of paving.	Annual cost of paving per square yard				
	Annual payments				Average annual cost per square yard for 20 years.
	Principal.	Interest at 4 %.	Annuity.	Maintenance.	
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Water bound macadam, under tarred heavy traffic, 2s. 6d. for three years	1·00	1·07	11·07	6·00	17·07
Jetsam, tarred paving, summer season, 4s. 6d. for four years	1·050	·82	11·82	4·00	15·82
Jarrah wood blocks, 4in. deep on 6in. concrete—					
Excavation and concrete, 6s. 6d., for 20 years	3·90	1·80	5·70		
Wood blocks, 12s. 9d. for 10 years	1·080	3·40	13·40		
	13·00	5·20	19·10	2·00	21·10
Creosoted deal blocks, 5in. deep, on concrete—					
Excavation and concrete, 6s. 6d. for 20 years	4·50	1·50	5·70		
5in. creosoted deal blocks, 7s. 6d. for ten years	8·00	2·30	11·00		
	12·50	3·80	16·70	2·50	19·20
Granite paving, 7in. by 4in., ordinary setts on 9in. concrete—					
Excavation and concrete, 5s. 3d. for 20 years	2·15	1·40	1·61		
5in. by 4in. ordinary granite setts, 12s. 3d. for 20 years	7·35	3·40	10·75		
	10·50	4·80	15·36	2·00	17·36
Granite paving, 5in. by 4in., hammer-dressed blocks on 9in. concrete—					
Excavation and concrete, 5s. 9d. for 20 years	3·45	1·60	5·05		
Special dressed blocks, 14s. 9d. for 20 years	8·85	4·08	12·93		
	12·30	5·68	17·98	1·50	19·48
Permanent asphalt—					
3in. surfacing, 3s. 9d. for 7 years	0·50	1·00	7·50	4·00	11·00

Mr. J. R. MEAD (Ipswich), seconding the vote of thanks, said he was gratified that the discussion on the question had been so successful, and he thought the subject could be very profitably discussed at certain other meetings which he was hoping to hold in other parts of the sub-district. Such gatherings enabled them to get the experience of all the members of the district, and the tabulation of the information in the manner suggested by Mr. Essex would, he agreed, prove of great value to them. With regard to tarring generally, the value of the treatment as applied to flint roads seemed to be a rather contentious point. Previous to going to the Eastern District he hardly ever saw a flint road, and he was astonished at the results which were being obtained there with the materials used. Considering the cheapness of the materials employed the results were really marvellous. In Ipswich their ordinary private street works—ballast roads—were carried out at a cost of only 2s. 4d. per square yard, including everything. Personally, he had obtained very satisfactory results from the tarring of flint roads. They used dehydrated tar, and the cost worked out at 1·397d. per square yard. On hills where they could not tar the whole of the road they tarred 1 yd. on each side, and they found that effectual in protecting the parts adjoining the channels. He used sand—a sharp sand with a certain amount of small pebbles in it—and he saw no reason to depart from the practice, which gave excellent results.

The vote of thanks was carried.

Mr. CROOME, in replying, said the gathering that day was his idea of what a meeting should be. They had been enabled to listen to something practical. With regard to Mr. Hall Smith's remarks, his (Mr. Croome's) experience had been that flint roads under light traffic were excellent. He was rather afraid of them at first, but he had found that they could get as good a flint road as a granite road. He quite agreed as to the usefulness of the tabulation of statistics on the lines suggested by Mr. Essex; with information before them in such a form they would know where they were. He did no gritting in Ipswich; he used instead a little sand, and had few complaints as to slipperiness.

THE ORPHAN FUND.

Before resuming his seat Mr. Croome raised the question of the Institution Orphan Fund. He was not a subscriber himself, but he felt that the fund could be put on a more democratic basis. His idea was that subscribers should have the power of voting for candidates in proportion to the amount of their subscriptions.

The members were entertained to tea by Mr. F. H. Barclay, J.P., chairman of the Cromer Highways Committee, at his residence, "The Warren." Visits were afterwards paid to the town's store yard, the electric lighting works, the fire station, and the destructor.

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—**The rapid increase of sand wastes around our coasts is indeed a serious one, and Mr. Case has done a valuable work in the writing of this book.**—*Southport Guardian.*

Wigan Corporation Tramways.—The borough engineer of Wigan, Mr. A. T. Gooseman, has recently reported on the condition of the whole of the narrow-gauge tramway track belonging to the corporation. The council have decided to remodel about 4 miles of tramway track, and they are entering into a contract with the Woods Gilbert Rail Planer Company. The Tramways Committee have decided to carry out a scheme prepared by the borough engineer for a new lay-out, with a double line at Standishgate, Crompton-street, doing away with a crossing on the curve and also improving the radius from 41 ft. to 52 ft. The estimated cost of this work is £1,126.

Contracts and War Prices.—In consequence of the increase in the cost of labour and fodder on account of the war, the Woodford (Essex) Urban District Council decided to determine Messrs. W. & C. French's contract for collecting house refuse, at a sum of £696 per annum for three years from March 31, 1914, and sub-stitute for it a contract at £900 with the same firm. The chairman (Mr. W. Henshaw, J.P.) said this would no doubt come as an unpleasant surprise to the ratepayers, but the council, in pure equity, had no alternative. They had, on the other hand, the option of either continuing the contract at the end of the term or making a better bargain elsewhere if they could.

SURREY MAIN ROADS.

COUNTY SURVEYOR'S ANNUAL REPORT.

At the last meeting of the Surrey County Council, Mr. A. Dryland, M.INST.C.E., the county surveyor, submitted his seventh annual report on the main roads, the assisted roads, and the bridges maintained by the county. The total expenditure on main roads certified in respect of the year which ended on March 31st last was £93,318 12s. 10d., the estimate sanctioned in May of last year being £114,957.

"There has therefore been a less expenditure than estimated for amounting to £21,638 7s. 2d., the two chief reasons being the inability to get material and the delay in starting the surfacing scheme. The result of this under expenditure is, unfortunately, visible on a great many of the roads, particularly those subjected to heavy traffic. On the other hand, no loans were received from the Road Board, and the total grants amounted to only £10,087, against an estimated amount (including proposed plant loan of £5,000) of £31,187. The effect of this variation is that so far certain amounts which should have been paid for out of loan have come out of current account, and will be the subject of subsequent adjustment with the Road Board. . . .

RESURFACING.

"With regard to resurfacing works carried out by the aid of Road Board grants since 1911, the slag tar-macadam has continued to give more satisfactory results than the granite tar-macadam. Most of the lengths of the last-named, laid in 1911, have been largely patched, and now require refacing. In some cases this has already been found necessary. Some of the early lengths of slag tar-macadam now require patching, but very little refacing is yet necessary.

"The pitch grouting results have been variable, but not to my mind sufficiently encouraging to invite extension. There seems a great difficulty in obtaining waterproofness, and the surface undoubtedly is more affected than most by summer heat, which causes movement in the material and subsequent unevenness and ultimate breaking up.

"The asphaltic surfaces have gone through the winter well on the whole. Where defects have developed it has generally been found to be due to weakness in the immediate sub-crust rather than imperfection in the material itself. In last year's estimate provision was made for commencing a large scheme of asphalt surfacing, at a cost of £87,972, subsequently increased to £91,630, part of which—that at the north-west corner of the county (Egham urban district)—was to be done chiefly by contract, and that on the eastern side of the county by labour employed directly by the county council, with special plant to be purchased by means of a free loan from the Road Board, while the whole scheme was to be financed by way of grant and loan from the Road Board, so that the cost to the county over a period of seven years was not largely to exceed the previous cost to the county.

WAR DIFFICULTIES.

"In common with most other undertakings these arrangements have been very greatly disorganised by the war, and the progress has been very much less than was anticipated. With regard to the length executed by contract, this was much delayed, and completion was driven into the very wet portion of the year. The portion of the work proposed to be carried out by direct labour was more seriously interfered with. In the first instance the formalities which had to be gone through in obtaining consents to loans before the order for the plant could be given occupied a long period, and made the time for delivery late in the summer. The outbreak of war caused further delay in the completion and delivery of the plants, and a portion of the plant—viz., two motor lorries out of three—was commandeered by the War Department. The result of these delays was that work was not commenced until the second week in September, and progress was hampered by the loss of the lorries and difficulties in obtaining delivery of materials. Moreover, owing to complaints arising from residents in the neighbourhood of the asphalt surfacing plant as to smell and dust, the working of this plant was considerably hampered, and it eventually had to be shifted to another site. The nett result of this accumulation of difficulties is that only 1¾ miles of the double coat resurfacing were executed in the last financial year instead of 4¾ miles which it was hoped to execute, but the retaining kerb was put in for a further 4 miles in readiness for the continuation of the surfacing this summer, and 1¾ miles out of 3 miles of the widening south of Horley were also carried out during the winter months.

"As regards the work done it is, I think, up to the highest standard of work of its class. The extremely wet winter and heavy traffic disclosed no defects, and I have every reason to believe it will have a very extended life. The plants purchased have worked satisfactorily, although one has not yet been proved to give the full output anticipated. The one motor lorry supplied by Messrs. Dennis Bros., Limited, has been eminently satisfactory, having done an enormous amount of haulage and enabled the work to keep going when railway facilities were practically cut off. If conditions had remained normal I am satisfied the whole scheme would have worked out quite satisfactorily, but under existing conditions there is naturally an increase of cost, as there is in every other kind of work. I may add that up to the time of writing the work in the current year is proceeding satisfactorily, if somewhat slowly. Owing to difficulties having arisen in regard to the granting of loans by the Road Board the financial arrangements are at present somewhat disorganised, but I have no doubt this can be satisfactorily adjusted when more normal conditions obtain.

WEATHER AND TRAFFIC.

"The early part of the year under review was very favourable for road maintenance, but the heavy winter rainfall—something like three times the normal—was exceedingly detrimental to all roads, and particularly so as it coincided with an exceptional amount of heavy traffic due to war conditions, by which this county was probably affected to a greater extent than most counties owing to its proximity to large army centres and the traffic to and from London in connection therewith. There was probably some decrease in the pleasure traffic during August and September, but this was far outweighed by the great increase in the delivery of materials by road owing to railway difficulties and to a large increase in the number of Army vehicles using the roads. It was very noticeable, too, that the speed and loading limits for all kinds of vehicles were practically ignored, and this materially accentuated the damage done. In this connection it may be of interest to the committee to learn that since the axle-weight ascertainer on the Portsmouth road was put in operation 33 per cent of the heavy motor cars weighed has exceeded the registered axle weights, and the one traction engine weighed was 4 tons 4 cwt. over the weight for which it was licensed. It is evident from the results so far obtained that overloading is very general, and it is most desirable that it should be checked.

TARRING.

"The spring and early summer were favourable for the execution of the work. The expenditure on surface tarring, exclusive of the contract urban districts, was £12,980 16s. 5d., or 1·62d. per yard super., as compared with £13,667 16s. 4d. and 1·69d. per yard super. in 1913-14. The total length tarred (exclusive again of the contract urban districts) was 170½ miles and 1,922,073 sq. yds., as against 171 miles and 1,935,881 sq. yds. in 1913-14. The tar again stood well on the lighter traffic roads, and particularly on the dry subsoils, such as the chalk. On the roads with heavy traffic the tar surface was more completely worn off than usual owing to the continual wet in the winter months."

A Glossary of Road Terms. By H. Percy Boulnois, M.INST.C.E. St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, E.C. Price 2s.—Mr. Boulnois has achieved far more than he may imagine by this production of his pen. He set out to standardise the nomenclature of road terms; in addition he had made a valuable addition to English literature. To the untutored it is like reading a new language; Mr. Boulnois says it isn't anything like "complete." At any rate, it is a valuable *vade mecum* which no one has attempted before.—*Portsmouth Times.*

"Dust-ups" with the Surveyors.—The Alnwick Rural District Council (says a writer in the *Alnwick Gazette*) has more "scraps" with its surveyors than any other rural council I have known. I move that the clerk communicate with the rural district councils of similar areas in the three northern counties enquiring how many "dust-ups" per annum they have with their road supervisors. This will be sufficient for purposes of comparison and as a guide to the future policy of the Alnwick Rural Council towards its enemies—its surveyors!

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Minutes of Proceedings.

The Protection of Ancient Buildings.

In many of our cathedral cities and older boroughs the protection of ancient buildings is an important part of the city or borough surveyor's work. In most cases he is fitted to carry out this work, not only by his technical abilities, but by his sympathies and local patriotism, which lead him to endeavour to preserve their historical and æsthetic character whenever it is possible to do so. In some cases the safety of the occupiers or the general public demand the demolition of old buildings long before the surveyor condemns them as unsafe, and many cases could be cited of old buildings having been allowed to remain standing long after they have become dangerous. This is especially the case in many of the half-timbered buildings found in our older towns, such as Worcester, Chester, or Shrewsbury. Often they have long been uninhabitable, and the owners have not the means, or in other cases the inclination, to make them safe, and prefer to pull them down rather than go to the expense of carrying out the work necessary to make them safe. The repairs required are frequently of so extensive a character that it becomes a question of restoration rather than repairs, and often nothing short of rebuilding will prove satisfactory.

The paper by Mr. Forsyth, F.R.I.B.A., on the "Protection of Ancient Buildings," which is reproduced in this issue, gives much useful information with regard to the treatment of these old buildings, and though many surveyors will not agree with all that he has written, they can all learn something on a very difficult and troublesome subject from his paper. In advocating the need of specialists to deal with these ancient buildings, he quotes the case of a London borough surveyor who dealt with an historic building in such a way as to arouse criticism, and who afterwards admitted that the views expressed by an architect specialist would have led to more satisfactory results, had they been carried out, than those actually carried out by the surveyor. Probably this does not prove very much, as most men, and certainly both architects and surveyors, are often "much wiser after the event." On the other hand, we must not forget that the strongest protests against the work carried out by such an eminent architect as the late Sir Gilbert Scott, or a powerful layman like the late Lord Grimthorpe, in the repairs or restoration of our cathedrals or old churches, has come from architects themselves. Much of the work required on ancient buildings and structures is of an engineering character rather than architectural, and it is the recognition of this which has led to the employment of Sir Francis Fox, rather than an architect, to repair Winchester Cathedral and many of our old bridges. Grouting under pressure is undoubtedly very useful, not only in the case of old churches, but also for bridges; and, as mentioned in the discussion on Mr. Forsyth's paper, it has been found very useful in the preservation of Chester's historic walls. It is also very valuable for under-pinning old buildings and bridges.

It must, however, be recognised that, while it is possible in the case of many old bridges so to repair them that they will probably be stronger than they were when first built, it is not always wise to do so. The increased weight and volume of modern motor traffic renders them inadequate, and even when repaired they are under this increased traffic often unsafe. Many of the bridges may be picturesque as ruins, but they are often so steep and so narrow as to be useless for the purpose they were intended to serve, and they are a hindrance to the development of the district in which they are found. They would be much better if replaced by new bridges more suited to the requirements of present-day traffic conditions. There is no reason why a modern bridge should not appeal to the sympathies of the artist or man of taste equally with an old bridge. It is largely a question of design and the use of suitable materials, for many modern bridges have much more pleasing lines and proportions than the older bridges which they have replaced. While most of the methods recommended by Mr. Forsyth can be safely adopted, the use of tiles for repairing rubble or ashlar walls, as shown in several illustrations in his paper, appears to be in very questionable taste. A coloured patch on a Dutchman's "breeks" may look very picturesque, but it is not quite the fashion one would expect a self-respecting Englishman to adopt. The ancient Romans used tiles very often in their rubble walls, and the mediæval masons frequently did the same, but they did it largely for the same reason as the "jerry builder" will use "bats" or "shoddies"—cheapness—and not to improve

the appearance or stability of the work. At the best, it is incongruous to patch an ashlar wall with tiles, and if their use is intended to convey the idea that it is mediæval work, then it is misleading and a sham.

* * *

Professor Schuster's Presidential Address.

Professor Schuster's presidential address to the British Association at Manchester was, we think, particularly interesting in the passages in which he discussed the task of defining the qualities of intellect and temperament which are necessary to success in different pursuits—science, engineering, and commerce. We are crudely in the habit of separating our human material into departments, and of insisting that special gifts are associated with different occupations. Professor Schuster regards this as a fallacy, and he is right, for experience teaches us that it is by a combination of many qualities, not the prominence of one quality only, that a man of business is capable of managing large and complicated transactions. Professor Schuster summed up this part of his thesis—the demand on the one hand for men of business, and on the other for scientific methods—in a few cogent words when he declared that "every method that leads to a correct result must be called a scientific method." What requires substantiating, he proceeded to say, is that scientific training is better than other training for discovering the correct method, and the proof of this has not been and cannot be given.

In expansion of his doctrine, Professor Schuster remarked that the most fatal distinction that can be made is the one which brings men of theory into opposition to men of practice, without regard to the obvious truth that nothing of value is ever done which does not involve both theory and practice. "Why," the speaker asked, "does a theory fail though it may be sound in reasoning? It can only do so because every problem involves a much larger number of conditions than those which the investigator can take into account. He therefore rejects those which he believes to be unessential, and if his judgment is at fault he goes wrong. But the practical man will often fail for the same reason. When not supported by theoretical knowledge he generalises the result of an observation or experiment, applying it to cases where the result is determined by an altogether different set of conditions. To be infallible the theorist would have to take account of an infinite number of circumstances, and his calculations would become unmanageable, while the experimenter would have to perform an infinite number of experiments, and both would only be able to draw correct conclusions after an infinite lapse of time. They have to trust their intuition in selecting what can be omitted with impunity, and, if they fail, it is mainly due to the same defect of judgment. And so it is in all professions; failure results from the omission of essential considerations which change the venue of the problem." Professor Schuster's address was in almost every respect an exception to the rule which has made similar orations in the past distinguishable more for abstruseness than practicalness, and it is quite conceivable that in handling his subject as he did he has done more real service to the world than half a score of learned dissertations on remote, startling, and sometimes not very comprehensible scientific hypotheses.

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Sanitation in War Time.

At the recent annual meeting and conference of the Midland centre of the Sanitary Inspectors' Association at Lichfield, the prevailing note was the necessity for maintaining the public health services of the country in the highest possible state of efficiency during the period of the war. The main item on the agenda was the reading, by Mr. H. H. Spears, of West Bromwich, of a paper with the rather unconventional title "In Chastened Mood." In the course of his remarks Mr. Spears pointed out that the work of sanitary inspectors has necessarily been curtailed owing to the comparatively large number who have responded to their country's call, either as recruits or in the special sanitary detachments which have been formed in connection with the Royal Army Medical Corps. In these circumstances he entered an emphatic protest—with which we entirely agree—against the demands which are being made in certain quarters for a practical cessation of public health work during the period of the war. Nothing could be more mischievous, for of all the public services which may be fairly described as "necessary," none are more important than that of applied sanitation. Mr. Spears proceeded to point out that, from all that we can learn, the activities of sanitarians in France or Belgium have been strikingly successful in preventing the spread of disease, which in all previous campaigns has exacted a far heavier death toll than shot or shell. From letters received from those at the Front, it appears that all the materials necessary to kindle a great conflagration abound. Conditions which we regard as revoltingly insanitary have to be dealt with, and it is only by the heroic and devoted efforts of the sanitary branch that grim pestilence does not walk unmolested in the ranks of our brave soldiers.

Surely the relatively clean bill of health presented by most of our forces must be accredited to persistent public health propaganda. Then, again, there has been the work performed by sanitary inspectors in our own country. It is no small matter for a busily-employed health officer working in a rural or semi-rural area suddenly to have the normal population of his district doubled or even trebled by the irruption of military forces. All his available resources are heavily taxed by demands for the removal and disposal of refuse, the protection of water and food supplies, the maintenance of billets in a sanitary condition, and the prevention of overcrowding, and here, again, the remarkably small incidence of preventable disease, considering the presence of large aggregations of men, is a striking testimony to the efficacy of sanitary work. No one would aver that precautions of this character, involving as they have done expenditure of public and private moneys, have not been amply justified, and the most rigid economist would hesitate to prescribe any slackening of sanitary effort in these directions. In these circumstances it is evident that some limit must be imposed upon the cry for municipal economy. No doubt economies should be exercised wherever practicable without prejudicing vital public services, but the public health must first be safeguarded. Mr. Spears is to be congratulated on having restated these truths with so much lucidity and conviction.

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The Trend of Modern Road Construction.

In a recent issue of The Surveyor, the writer of "Things One Would Like to Know" suggested that some useful information might be obtained if Appendix 2 of the Fifth Annual Report of the Road Board were dissected so as to show the areas of roads treated in various ways under the grants made by the Road Board. An endeavour has been made to do this with the first part of the appendix only, so far as England alone is concerned, and leaving out Scotland, Ireland, and Wales. Wood paving and certain proprietary articles have also been left out, and in some cases where the treatment adopted appeared to be

somewhat vague no notice has been taken, and in the case of two classes where the treatment of the road has not been divided between two methods mixed tar, macadam and tar has been taken as the figure.

The results are somewhat interesting, as they show the large amount of road surfaces in England which have been tarred by means of grants alone during the year 1914. This amounts to no less than something slightly over 19,500,000 sq. yds., and when it is considered that a very large amount of work of this description is also carried out in the ordinary way of maintenance, out of income, it is evident that surface tarring has lost none of its popularity among surveyors, although complaints are still made in some counties as to this treatment. The most popular appears to be slag covered with tar, in which, of course, is included Tarmac, the area covered having been about 2,078,000 sq. yds. This is closely followed by tar-macadam, the figure in this case being about 1,195,000 sq. yds. Nearly the whole of this is for granite coated with tar, which shows that, notwithstanding the recent controversy as to whether granite is the right stone to use for this purpose, it still holds its own. The next in order is what may be called bituminous carpeting, of which about 1,132,000 sq. yds. were laid, but this figure is swelled by the adoption of this method to a large extent in and near London, where it has lately become very popular. The next in order is pitch grouting, or grouting with various proprietary articles, as the figures for this give an area of about 995,000 sq. yds. It is evident, therefore, that although there have been some failures with regard to this system, it is still looked upon with favour in some districts. With regard to stone sett paving on concrete, nearly 200,000 sq. yds. have been laid, but it shows that there is still a field for this class of pavement under certain conditions.

A considerable amount of labour was involved in dissecting the figures, and they may not be actually accurate, but they are sufficiently reliable to act as a guide as to what has been done in the direction of road work for the period under review. The report of the Road Board as it stands only consists of very dry statistics, but to a keen student who has the leisure there are no doubt many facts which might be useful if extracted by patient and laborious "digging."

* * *

Bradford Water Supply.

It is not long since an inspector of the Local Government Board visited Bradford for the purpose of inquiring into the city council's contention that the completion of the duplication of the pipe-line from the Nidd Valley—the chief of the works now proceeding in connection with the water undertaking of the corporation—was essential to the industry and welfare of the city. The valley of the Nidd, over 30 miles away, is the main source of Bradford's water supply. The water collected from 18,200 acres of gathering ground consisting chiefly of moorland, and stored in the valley, is brought to the city through tunnels, aqueducts in cut-and-cover work, and large cast-iron and steel pipes. Some twenty years ago, when the first main capable of delivering 10,000,000 gallons a day, was laid, the large permanent works, such as tunnels and aqueducts, were constructed with a capacity of 20,000,000 gallons a day in contemplation of the time when the city would require additional supplies. That time having been reached, the corporation are engaged in duplicating the main, an undertaking involving the laying of a second pipe-line nearly 15 miles in length and an expenditure estimated at £200,000. The work has been in progress for some time, large numbers of pipes, 36 in. in diameter, have been deposited along the corporation's easement, and in the Aire Valley a considerable length of the line has been laid.

The Local Government Board now propose to stop this work. The board have intimated, in effect, (1) that they are prepared to approve the expenditure which has been incurred during the negotiations between the board and the corporation; (2) that they are prepared to consider an application for sanction to raise such moneys as may be necessary to complete the work in the Aire Valley, which is now approaching completion; and (3) that they consider the work which is principally in the Wharfe Valley and beyond should be immediately suspended, and, similarly, works adjacent to the new Angram reservoir in the Nidd Valley. The decision of the board has come as a surprise to the corporation, and there is a probability of further representations being made, inasmuch as it is feared that if the work is stopped there will be the risk of a serious shortage of water next year should the summer be a dry one.

* * *

The Disposal of Trade Wastes.

A perusal of the report, which we printed in our issue of August 27th, upon the Ninth Report of the Royal Commission on Sewage Disposal is very illuminating. It is written by the two chief officials of a rivers board for the purpose of informing the members of the board as to the effect of the recommendations of the Royal Commission if they were put into operation. The authors, Dr. H. Maclean Wilson and Mr. H. T. Calvert, have such a wide practical experience in the subject upon which they write that their views must be accepted with great respect, and will undoubtedly be given careful consideration when the time arrives for the drafting of any Bill that may be brought forward to place the recommendations of the Royal Commission upon the Statute Book.

One of the points made by the authors which strikes the ordinary reader very forcibly is that the commission admit that they have been quite unable to complete the investigations they desired to make, and it is not surprising that the authors regret that the commission committed themselves to such important recommendations without having been able to study the various questions more closely. Another interesting paragraph is that in which the authors describe the various legal proceedings which may take place if the recommendations of the commission are adopted and a manufacturer decides to object to the standard of purification fixed by the rivers board for his effluent. Some people think that all laws are made in the interest of the legal professions, and there would certainly seem to be some basis for such a view in this case. The authors state their case mildly when they say that the procedure of the rivers board would certainly not be any more direct or less cumbrous than at present, and that it would leave many opportunities for delay on the part of the manufacturer. Again, it is pointed out that the alterations of the law suggested by the commission seem expressly to nullify the recommendations that there should be prescribed standards, since it is suggested that they can be altered in any individual case on appeal either by the rivers board or the manufacturer. These and other criticisms are very much to the point. Indeed, the whole report is of great interest, and will, we feel sure, be found of great value in a very much wider circle than the rivers board for which it was primarily written.

Sewage Pumping.—The borough engineer of Margate, Mr. Ernest A. Borg, would like to communicate with any municipal engineer who has sewage pumps driven by gas or oil engines, through gearing, and without any belting.

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Camp Sanitation.*

By H. R. KENWOOD, M.B., D.P.H., F.R.S.E., Temporary Lieutenant-Colonel R.A.M.C., Professor of Hygiene and Public Health in the University of London.

As military camps may present such a variety of provisions as to sanitation, one who opens a discussion on "Camp Sanitation," and has but a few minutes to devote to the subject, must decide what kind of camp shall be selected and what branch of sanitation shall be chosen for reference. I conclude that it is desirable at this meeting to deal with the semi-permanent (hutted) camps which now abound in this country. Indeed, I cannot claim a detailed acquaintanceship with others. I propose therefore to devote my few remarks to the collection and disposal of human fæces in such camps. What are the methods adopted, and how do they compare from the sanitary and economic standpoints?

The method which has been commonly selected is a pail system, with the pail contents disposed of either upon land or by cremation in a destructor. In the former case the work of removal and disposal is performed by local contractors, and results are dependent upon an available area of suitable soil, an area which is safe from the standpoint of local water supply, and which, while not too distant from camp, is outside the half-mile limit; the employment of proper tumbrils, with watertight covers; a fairly good road from the camp to the area; and the suitable application of the fæces to the soil. All these demands must be met before such a method can be recommended; and it has been found very necessary to keep the contractor's arrangements under supervision. Indeed, the existing terms of agreement with such contractors need considerable strengthening. It should be required that the nightsoil shall not be merely dumped on any area, but that it shall be dug or ploughed in, or trenched, within twenty-four hours; and that the area it is proposed to utilise should always be approved of by the General Officer Commanding and the district medical officer of health. As no trouble is to be anticipated from the breeding of flies if the material is well spread out, it does not seem necessary to require that the fæces shall be covered with more than a few inches of earth. The terms of payment vary somewhat in different districts, but the long cartage involved makes this method a costly one; and the effect of the adoption of the above suggestions with reference to the contracts would add to the costs, and may be to the difficulty in securing such contracts in some districts, owing to the scarcity of labour.

By the cremation of the pail contents upon the camp area the expense of transport is materially reduced, but the other expenses involved combine to make the system costly. The arrangements made in this country take the form of either small unit destructors, capable of dealing with the daily fæces of a battalion, and located within the camp area, or a larger destructor, or destructors, to serve two or more units, placed on an outlying part of the camp to leeward of prevailing winds. In either case satisfactory results are dependent upon the employment of a considerable proportion of readily combustible material; a proper admixture of this material with the fæces, and the skilled feeding and working of the destructor. In addition to a certain amount of suitable dry camp refuse, sawdust, shavings, breeze, &c., generally have to be burnt with the fæces (or fæces and urine in some cases), and these materials are at a high price when delivered to an outstanding camp. With the small unit destructors the cost is less, mainly because they are disposed adjacent to the latrines, and so hand transport becomes possible and the expense of cartage is saved. The large destructors vary in their results, but they are generally far less satisfactory than the small unit destructors, they are more costly, and they often fail to meet military requirements; but both forms often break down in practice, especially in wet weather. In this cremation system the main problem is the supply of suitably trained labour, and the keeping down of the cost of this item. One has commonly found the same type of destructor to be producing good results in one camp and dismally failing in another, and, of course, the explanation is the human element. Suggestions for reducing the working expenses take the form of a light railway to the large destructors, and the cheapening of labour by the employment of a proportion of Class "B" soldiers (invalided home and unfit for the front) in the working of the incinerators and regimental transport.

Of course, there are comparatively cheap methods of incineration, largely practised in military camps in America, such as the American "oil pits." I have seen two of these working very satisfactorily upon Salisbury Plain. They consisted of chalk pits 4½ ft. deep, and from 10 to 12 ft. square, and in each of these pits the fæces and urine of two battalions were disposed of in from ten to twelve hours by means of five gallons of paraffin oil and four bags of shavings. The pit contains a false bottom of perforated stout-gauge corrugated-iron sheets, and the urine collects below this platform, when the burning oil floating upon it rapidly evaporates the urine and leads to the complete combustion of the mixture of fæces and shavings supported upon the false bottom.

Latterly, as the result of experimentation, this provision has been modified in the following directions: A long lined pit, 4 ft. in breadth and 21 ft. in length, receives the urine and fæces, and running below the whole length of steel floor is a narrow chamber, which is maintained at a fierce heat by three "Primus" blowers, burning paraffin. These improvements have the effect of reducing the cost; for each such pit deals with the fæces and urine of four battalions a day, with a saving in the labour and of the fuel (shavings, &c.) which formerly had to be employed. I am informed that at a distance of 50 yds. the fumes of these pits do not give rise to any complaint from offensive odours. Of course, it is recognised that such pits must be placed at least 50 yds. from the nearest huts, and that their use involves the expense and other drawbacks of cartage.

Where the fæcal pail system is adopted there always remains the difficulty of disposing of another dangerous part of human camp refuse—viz., the urine. It is unnecessary for me to dwell upon the dangers of using urine pits in many camps, and the spillage which is inseparable from the collection and removal of the urine; nor need I do more than remind you that it is difficult and costly to provide for the disposal of all the urine by destructors. These facts are responsible for the provisions of drains in most of our hutted camps to take the urine and sullage waters. Where this is done it is easily practicable in most cases to provide water-closets, and to thus instal a complete water-carriage system for the camp. The urine and sullage waters have to be dealt with similarly to sewage, and the inclusion of the fæces, while necessitating some extension of purification plant, or of land for irrigation, would tend to make the production of a suitable effluent more easy, and no extra hands would be necessary for management purposes.

The Water-Carriage System.

It is unnecessary for me at this meeting to dwell at length upon the sanitary advantages of the water-carriage system over the other systems. It entails no handling of pails and no cartage of fæces, and therefore there is no spillage; and as the surface soil of the camp is kept free from such contamination, the fly and dust dangers, and the risk of boot-carried infection of the huts practically disappear, and with them much opportunity for the spread of enteric fever when the disease is introduced into the highly susceptible camp population. Our experience of conservancy systems in civil communities awakens misgivings, which are not reduced by a study of military camp experiences; and, where the dangers inseparable from such systems in crowded communities can be practically prevented at little or no extra cost, one is naturally favourable to such a course in connection with camp communities in which sanitary inspection and control and the sanitary discipline of the men leave something to be desired. In the new army plan of hutted camps, where the latrines are placed between the lines of huts, I am of opinion that such latrines should always, where possible, have water-closets installed.

The water-carriage system with range water-closets (separate pans and automatic flush) has rarely been installed in the first instance in connection with our semi-permanent camps; but, in cases where urine

* Paper read at the sessional meeting of the Royal Sanitary Institute held on Friday and Saturday last at Brighton.

and sullage waters are already received into 6-in. cement-jointed mains, these will generally suffice for a complete water-carriage system to be introduced, involving a water supply which should not be less than 12 gallons per head per diem.

In the water-carriage system satisfactory results are dependent upon: A sufficiency of water at the camp, and the adequate protection of the flushing cisterns and pipes in exposed water-closet compartments; sufficient falls for the drains and purification plant; a suitable discharge for the crude sewage or effluent; and, where purification plant and land irrigation are provided, one or more men to look after matters, and these men should be under proper sanitary supervision. (Such provision, along with an extra large area of land, will generally secure satisfactory results, even when the nature of the land is far from ideal for sewage irrigation.) Where bacterial purification plant has to be provided and a high-grade effluent has, owing to local topographical and other circumstances, to be maintained, this system is costly as to installation; but, with water at a reasonable cost, the expense of upkeep is extremely low as compared with other systems.

For the above reasons I share the view with many others that, where practicable, a complete water-carriage system should always be provided in semi-permanent camps. A water-carriage system is particularly desirable when such camps are situated in the immediate outskirts of towns; it is, moreover, by far the cheapest provision that can be made when existing sewers are capable of taking the camp sewage, or when (as in many instances) a reasonable length of pipe will conduct it into the sea. There are, of course, many local circumstances which have to be weighed before deciding as to whether a water-carriage system with a purification plant is practicable, and can be provided at a reasonable cost; but, as there can be no question of its being the most sanitary form of provision, I would advocate it even if it involved some additional cost as compared with alternative systems. I have had the advantage of seeing some estimates of the comparative cost of the different systems I have alluded to, and these have been prepared by one who brings expert knowledge and great experience to bear upon such matters. These estimates relate to special camps, and therefore vary with local circumstances. So far as the water-carriage system is concerned they mostly relate to the installation and running expenses of converting a pail system into a water-carriage system in camps where the sullage and urine drains already installed are capable of taking the water-borne sewage. In estimating the comparative cost of rival systems there is the difficulty that we are ignorant of the duration of the military occupancy or the subsequent use to which any existing camp may be put, and such local circumstances as cost of labour, cost of water, the scale of purification plant provision necessary, &c., vary considerably; and so anything more than a broad statement is impossible. But, after considering the facts in reference to many hutted camps now in this country, it is safe to say that in the first year there is generally little to choose between the cost of incineration of pail contents by small unit destructors and contract collection and disposal on land, and where urine and sullage drains are to be (or have been) installed in camps the extra cost of the complete water-carriage scheme will generally fall short of that of the above two methods. But when we come to consider the comparative cost of the three systems when spread over a period of two years, the unit destructor represents a material saving upon contract collection and disposal on land, and the water-closet system a very great saving indeed as compared with the cost of the other two. The large destructor is the most expensive method of all, and the pit incineration method described is somewhat the cheapest. Of course, in peace time, when labour is cheaper, the contract disposal on land system is much less expensive, and would then compete more successfully with other systems.

Thus I am led to the conclusion that the best provision where semi-permanent camps are concerned is the complete water-carriage system, and where this is impracticable probably the pail system, with small unit destructors sited close to latrines, is, when worked by a military sanitary squad, the next best. The suitability of the pit system must be regarded as *sub judice* for the time being where large semi-permanent camps are concerned, although it is an admirable device for less permanent camps. The contract system cannot be recommended, save as a very temporary measure; for, in addition to its heavy cost, it is the least satisfactory from the sanitary standpoint.

Lastly, I should like to say a word upon the provision of trained sanitary supervision, without which no system of sewage removal and disposal is complete. I have witnessed many instances during the past twelve months in which the lack of this essential provision has led to trouble, and it seems to me that there should be in all camps a specially appointed sanitary officer with the necessary staff at his disposal, and, where different units are occupying the camp at short intervals, there should become small stationary sanitary personnel maintained. I take the view that sanitary detachments specially enlisted for the purpose, and controlled by sanitary inspectors with suitable rank, would, generally, [illegible] the standard of sanitation in our [illegible] permanent camps.

REINFORCED-CONCRETE ROAD FOUNDATIONS.

The accompanying view is of the Station Approach at Golders Green, laid in February, 1913. This was a new road laid on ground which had previously been [illegible]. The road is still [illegible] B.R.C. Reinforced Foundation. The contractor have [illegible]

[illegible] traffic. Since it was laid nothing has been spent on the road, and to-day it is in perfect condition. About 200 'buses per day (300 on Sundays) make a return journey over this approach. We understand that the firm of contractors responsible for the work informed the B.R.C. Company that this is the finest job they have laid.

CORRESPONDENCE.

Εἷς ἄνηρ οὐ πάντ' ἐπίσταται.
(One man does not see everything.)
—EURIPIDES.

THE LILIAN BRADSHAW FUND.

To the Editor of THE SURVEYOR.

SIR,—Herewith a small donation (10s.) to the fund being raised for the widow and child of the late Mr. Bradshaw.

I hope to see this fund considerably increased yet, and no doubt it will be when the many municipal officers who are at present on holiday return to office, and are aware that it is still open.

At present the smallness of the total gives rather a handle to the opponents of the superannuation scheme for municipal officers, as it appears to prove that the latter do very little in the way of mutual help.—Yours, &c.,

SMALL FRY

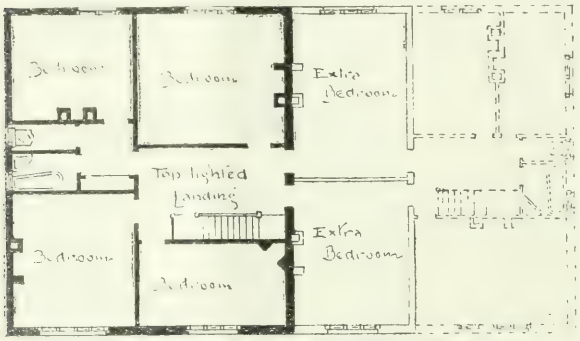
September 3, 1915.

Waterproofed Cement Rough Cast.—Rough-casting on brickwork is considered an innovation in those districts provided with a local building stone. For the ninety brick dwelling-houses erected at Bradford under the city architect waterproofed cement rough cast was adopted. We understand the city architect has also specified a large quantity of Pudlo for the rough-casting on the Grassington sanatorium.

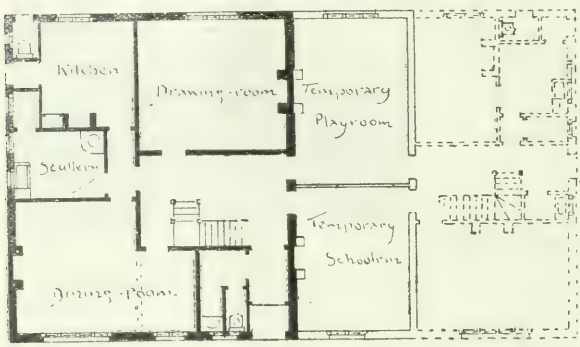
THE "CONVERTIBLE" HOUSE.

By CHARLES H. BRESSEY, F.S.I.,
Surveyor to the Wanstead Urban District Council.

While the public mind is occupied with questions of economy attention may usefully be directed to the notorious loss frequently incurred by house-owners (and rating authorities) owing to the impossibility of adapting the ordinary house to the varying demands of a changing locality. Indeed, the element of "adaptability" appears rarely to enter into the calculations of the designer, although so many streets afford cautionary examples of the large house which



First Floor Plan (additional rooms in roof above).



Ground Floor Plan.

SKETCH PLANS ILLUSTRATING THE "CONVERTIBLE" HOUSE.

stand empty because of the declining character of the neighbourhood.

By the exercise of a certain degree of foresight it should surely be possible in many cases so to contrive the original design as to provide some facilities for subsequent alterations. The difficulties are by no means overwhelming, and the problem presents varying features of interest, akin to those successfully solved by makers of "elastic" bookcases.

The annexed diagram may serve as an outline illustration of the "convertible" principle in house design applied to a case where the original owner desires a house larger than the average requirements of his neighbours; the plan provides him with a detached house which can later be extended and converted into two smaller semi-detached houses.

The left-hand portion of the diagram, with walls in solid black, shows what may be termed the "safe medium" house, which would be too small for the first owner; his exceptional requirements, however, are met by the additional rooms drawn in black line. These rooms, as will readily be seen, are capable of "severance," and can at any time be converted into a second semi-detached house by the addition of the building drawn in dotted line.

The foregoing scheme is a mere draft, and is confined to bare essentials, but a similar principle of "convertibility" could doubtless be applied by more ingenious designers in many widely differing cases.

MIDDLESEX COUNTY ROADS.

ROAD BOARD AND ARTERIAL ROADS SCHEMES.

The Highways Committee of the Middlesex County Council published recently their annual report for the period ending March 31, 1915. The council, it is therein stated, have continued to repair by their own men the main roads, including footpaths, in the rural districts, and in all urban districts which have not claimed to retain the powers and duties of repairing and maintaining main roads. The arrangement appears to be satisfactory, and the roads are reported to be generally in a good condition. Tar-painting of main roads, in the districts of the local authorities who have claimed to maintain, have been carried out by the authorities in question, the county council making the following allowances: If carried out by hand labour, 2½d. per yard super.; if carried out by horse machine, 1½d. per yard super.; if carried out by mechanical spreaders, 1d. per yard super. The lengths of roads treated have to be first approved by the county engineer and surveyor, and the charges for watering on roads thus dealt with must not exceed ¼d. per square yard per annum. On unpainted roads the charge must not exceed 1d. per square yard per annum. The work is inspected by the county engineer and surveyor when it has been carried out.

The local authorities have, during the year under report, carried out tar-painting operations on many of the subsidised roads in their districts, and charges are allowed to be made against the county council on a scale similar to that fixed in the case of main roads, previously referred to, the county council bearing a moiety of such charges in the case of "A" roads, and one-fourth in the case of "B" roads. During the year under review the county council agreed to contribute towards the improvement and resurfacing of certain subsidised roads under the scheme of improvements dealt with by the Road Board a sum amounting in the aggregate to £6,130 0s. 10d.

THE ROAD BOARD SCHEMES.

The report proceeds to state that in July, 1914, the county council agreed, subject to the Road Board contributing one-third of the cost of the works, to carry out certain improvements to main roads, and to contribute to the district councils in respect of improvements carried out by them. The total cost of the improvements selected amounted to £340,737, of which the county council's proportion would be £203,318. Detailed estimates, plans and particulars were prepared for submission to, and the final approval of, the board, and in the course of the year the Road Board agreed to make grants of one-third of the cost of certain of the improvements, and the county council agreed to make contributions on a specific basis to the district councils. The contributions of the county council to the local authorities will be made by allowing the district and borough councils to charge instalments of principal and interest in their annual accounts against the county council. A number of improvements which were embodied in the general scheme have not yet been finally dealt with.

THE ARTERIAL ROADS SCHEMES.

In connection with the schemes for arterial roads for Greater London, which has been under the consideration of the Arterial Road Conference, and by them delegated to sectional sub-committees, the Highways Committee report that it was thought desirable that, besides the routes receiving the consideration of the North-Western sectional sub-committee, the question of two main routes through the county from north to south and from east to west should also receive attention. On February 25, 1915, the county council viewed with favour the principle of two arterial roads in the county from east to west and from south to north, between the following points: (1) From Den-

ham, Bucks, through the county to the Colchester road, and (2) from Chertsey, Surrey, to join the west to east route at Redhill, Edgware-road, and continuing thence to join the St. Albans and Great North roads at Hadley High Stone. Details and plans of these routes have been forwarded to the Local Government Board for the consideration of the north-western sectional sub-committee. The county engineer has been directed to keep in touch with Colonel Hellard, the Board of Trade engineer, who is advising the Arterial Road Conference upon this question, and the county engineer has also been asked to consult with the engineers of the local authorities concerned in connection with these two suggested new routes. Reference is also made by the committee to the scheme for the construction of the Great West Road, in connection with which negotiations are proceeding for the acquisition of the necessary land and property.

THE COUNTY ENGINEER'S REPORT.

Appended to the report of the Highways Committee is the report of the county engineer, Mr. H. T. Wakelam, M.INST.C.E., who writes:—

Owing to the war crisis, there has been much difficulty experienced during the latter half of the year under review in connection with the maintenance of roads generally. Inability to obtain materials and scarcity of labour have to a great extent delayed the ordinary renewal works. Having regard to these circumstances, I do not propose to withhold any certificate in connection with the annual maintenance and upkeep of the main roads of the county. The all-round increase in the cost of materials and labour caused by the war will, no doubt, cause a large expenditure to be incurred on the maintenance of main roads during the current year, especially so when it is remembered that many of them will require extra materials and attention owing to the war traffic. It will be remembered that in the early days of motor-car traffic all kinds of theories in regard to road maintenance methods to withstand the said traffic were advanced, and in this connection a great number of proprietary materials were placed on the market, the owners of which claimed to have solved the problem of successfully coping with the new traffic conditions. The test of time, however, has proved that many of the materials referred to were almost worthless to stand the stress of mechanically propelled vehicles, and one is more confident now in advising as to what materials may be used to resurface a given road to meet the needs of the traffic it has to carry.

In this connection the following paragraph appeared in my annual report on roads which was submitted to the County Highways Committee in June, 1912:—

"What is badly wanted, generally, at the present time is something that will come, with a reasonable life, between an ordinary water-bound road (tar-painted each year) and creosoted deal paving. I believe it will be found, as time goes on, that the something will be in the nature of asphalt. If I am right, and it should be so, the damage from the motor-bus traffic, which is increasing so rapidly in Middlesex, should be to a great extent relieved." Since the date of that report I have prepared specifications for resurfacing roads with a material known as asphaltic macadam, and some 132,000 yds. of road surface (directly maintained by the county council) have been resurfaced with this material. The cost was, including a ten years' maintenance period, 10s. 3d. per yard. This method of resurfacing appears at present to be fulfilling anticipations, and appears to be going a long way to solve the problem of maintaining a road where the conditions are such that water-bound metalling is undesirable, or where the traffic does not warrant the use of a paving with a concrete foundation. The St. Albans (main) road between Barnet and the county boundary has been treated with a native Trinidad matrix, but, having regard to the present price of granite, and to the subsequent maintenance charges, this (grouting) method of resurfacing cannot be regarded as so satisfactory as the asphaltic system above described, either from a financial or wearing point of view.

ROAD IMPROVEMENTS AT CLYDEBANK.

By GEORGE ROSS,
Burgh Surveyor.

Owing to the development of the Dalmuir district of Clydebank, it was found expedient that the Park-road should be improved. This work would have been held over until the finish of hostilities had it not been that the ground owner on one side was going ahead with villa construction. His ground was also separated from the road by the Boquhanran Burn. Owing to the burn repeatedly overflowing, the road itself, during the winter months, was always in a very bad condition, and it was decided to culvert the burn and raise the road on an average of 5 ft. and widen it to 50 ft., made up of two footpaths 10 ft. wide and a 30-ft. carriageway, the ground proprietor giving the necessary ground for widening free.

The culvert was built of reinforced-concrete blocks composed of clinker from the refuse destructor, and the reinforcement was the scrap steel from the Singer Manufacturing Company, Limited, which is in long perforated strips about 4 in. to 6 in. wide by ⅛ in. thick. The amount of cubic filling required to bring the road up to its new level was about 24,000 yds.

PARK-ROAD IMPROVEMENT, CLYDEBANK.

The bottoming was of whinstone, 9 in. deep, and hand-set, on top of which 4 in. of 2-in. broken whinstone metal was spread and rolled, using whin dust for blinding. The finishing coat of metal, 3 in. to 4 in. thick after rolling, was hand-grouted with Mexphalte bitumen, the grout being in the proportion of 80 per cent Mexphalte to 20 per cent Fluxphalte. This was applied at a temperature of 400 deg. Fahr., at an average of 1¾ gallons per square yard, the surface being immediately covered with ¾-in. whin chips and immediately rolled. The surface was afterwards sprayed with the same proportions of Mexphalte and Fluxphalte, using about ¼ gallon per square yard, and chipped again, the whole being given a final roll with the steam roller. On one portion steel slag was used, as a trial, instead of whin chips.

Below I give details of the finishing coat and cost:—

	£	s.	d.
Wages	65	7	8
Horse work, 440 hours at 1s.	17	0	0
2-in. metal, 360 tons at 4s. 6d.	81	0	0
Mexphalte	178	10	2
Fluxphalte	25	18	6
¾-in. chips, 81 tons 5 cwt. at 5s. 5d. per ton	22	0	2
Steel slag, 25 tons 13 cwt. at 7s. 4d. per ton	9	8	1
Coals, 7 tons at 25s. per ton	9	16	0
Road roller, 10½ days at 25s.	13	2	6
Hire of boilers	6	0	0
Carriage on boilers	2	15	7
	£430	18	8

Total grouting and flushing = 232 gallons per yard.
Total area of work = 2,852 sq. yds.
Cost per square yard = 3s. 3d.

Missing Surveyor's Body Found.—The body of Mr. Harold Edward West, the late assistant surveyor to the Canterbury Corporation, who had been missing since August 23rd, was found in the Lesser Stour River on Saturday.

Royal Sanitary Institute.

PROVINCIAL SESSIONAL MEETING AT BRIGHTON.

A variety of interesting subjects came under consideration at the provincial sessional meeting of the Royal Sanitary Institute which was held on Friday and Saturday last at Brighton. As a consequence of the war the customary annual congress will not take place this year, but it was felt by the council of the institute that a gathering of a less ambitious nature might very well take place, and it was accordingly decided to have a curtailed meeting, making the business as far as possible appropriate to the time. The many and peculiar problems connected with the hospital treatment of Indian soldier patients, the use of storm-water drains to ensure safe water supplies being obtained from polluted catchment areas, and the important question of camp sanitation were discussed at the first day's sitting, while on Saturday the recently issued Final Report of the Royal Commission on Sewage Disposal came in for some attention. Friday's arrangements included visits to the Indian hospitals, the local school clinic, and a mayoral reception at the public library, and on Saturday those attending the meeting were afforded an opportunity of inspecting the military camp at the adjoining town of Shoreham and the Brighton electricity works.

Assembling on Friday morning at the Permanent Art Gallery, under the presidency of Sir Henry Tanner, chairman of council of the institute, the visitors received a cordial welcome from the MAYOR (Alderman Otter, J.P.). His Worship said the question had been raised this year by many societies and institutes as to whether they ought to hold meetings. It all depended upon what the society was; but he could not conceive anyone offering any objection in the case of the Royal Sanitary Institute. It was true the war was dominant in our minds, and that everything else must be subservient to it; but when studying the essential question of health there must always be room for such a meeting as that. There was hardly any matter so important as public health. It was an end in itself, and a means of the exercise of the highest functions of character and intellect.

Councillor BLACK also spoke, observing that Brighton welcomed a conference whose object it was to give attention to the physical and moral well-being of the people.

INDIAN HOSPITALS IN ENGLAND.

"Sanitary Problems in Hospitals for Indian Troops in England" was the subject of a paper by Major S. P. James, M.D., of the Kitchener Hospital at Brighton, which is equipped to accommodate over 2,000 patients, and is run by officers of the Indian Medical Service, with a staff of assistant surgeons and sub-assistant surgeons belonging to the Indian Subordinate Medical Department, and a personnel numbering about 400, comprising Indian nursing orderlies, storekeepers, writers, water carriers, conservancy sweepers, and other followers. Among the hospitals in England it is unique, in the absence of female assistants, to see the laundry work being done by Indian washermen, specially brought for this purpose.

Major JAMES described the structural alterations that had to be made in the Brighton Union buildings, and adapt them to the purposes of the Kitchener Hospital, and spoke of the provision made for enabling Indians to live in accordance with the customs of their country. He introduced to the members of the institute typical representatives of some of the races now accommodated at the hospital, and pointed out that all these classes had customs and prejudices differing from each other, and which must be strictly adhered to and safeguarded in order to prevent the individual members from losing caste. There were eight different kinds of diet. The food of the patients was cooked in twenty-one cook-houses in the hospital grounds, and that of the subordinate staff in sixteen cook-houses in the villages. Hindu cooks must in all cases be of the same or of a higher caste than the patients for whom they cooked. The chief article of diet of all the fighting races in India was a kind of bread made from partially-husked grain ground by hand between two slabs of stone. In regard to meat, all Mohammedans ate beef, but the practice was very abhorrent to Hindus, who regarded the cow as a sacred animal. For this reason no beef was allowed inside the hospital. Bacon and similar meat was also strictly prohibited, as Indians must themselves slaughter the sheep which they used for food, and they must do it in the special manner enjoined by their religious sects.

They had been provided in the grounds of the county abattoir with a new slaughter-house for this purpose. For Hindus the custom was to sweep the head of the animal off the neck with only one stroke of a talwar or sword. For Mohammedans the mouth of the animal must be pointed towards Mecca. The man who killed for Mohammedans should be one who prayed five times daily, and he must utter a prayer at the time of slaughter. When he mentioned that an Indian must bathe the greater part of the body before each time of prayer, and that a good Mohammedan must pray five times daily, they would not, perhaps, be shocked to hear that the amount of water used in the hospital averaged between 60 and 70 gallons per head per day.

As illustrating the difficulties connected with dealing with Indians, he mentioned that the flooding of bath-rooms had been very common, and water had been wasted, as, after turning on the water, they did not seem to see the necessity of turning it off. Again, before the introduction of electric light at the hospital, they were frequently in danger of gas poisoning through the persistence with which the Indians blew out the gas instead of turning it off. Referring to the funeral arrangements of the patients, he remarked that Hindus who died were cremated by a member of their own caste on a specially prepared site on the downs at Patcham. The burning was done on a funeral pyre of wood logs in precisely the same manner and with the same ceremonies as would be performed in India.

Mr. E. T. HALL proposed, and Mr. R. H. CLEMENT, the deputy borough surveyor of Brighton, seconded, a vote of thanks to Major James for his paper. Mr. Clement stated that the buildings now used as Indian hospitals were taken over on November 21st, and the first patients were brought in three weeks later. His chief, he remarked, had acted as adviser in the work of conversion. The greatest difficulty had been experienced in avoiding waste of water, and in one of the institutions the consumption was as high as 100 gallons per man per day. There were cases of Indians taking a bath who turned on the hot-water tap, and, finding it too hot, did not turn on the cold-water tap, but allowed hot water to run away until it was nearly exhausted and cool enough to suit them. The experience of being associated with the work of providing special sanitary appliances in the Indian hospitals had been a valuable one, and both he and his chief much appreciated the courteous and generous way in which they were met by the officers in dealing with the difficulties that had arisen.

WATER SUPPLIES FROM POLLUTED AREAS.

A paper on "The Use of Storm-water Drains to Ensure Safe Supplies being Obtained from Polluted Catchment Areas" was next contributed by Major C. C. Murison.

Major MURISON said the question was not of common occurrence, and so the ordinary books of sanitary science did not even mention it; still, in his opinion, it was of interest to the sanitarian.

In order to describe this subject he could not do better than briefly enumerate the several points which had to be taken into consideration in a place where very shortly a storm-water drain for the above stated purpose would be constructed. The place was Matheran, a small station situated on the top of a hill, which rose very abruptly from the plains and was quite separate from any other hill. The hill consists of Deccan trap rock overlaid with a crust of laterite. The former was an igneous rock, and was impervious to water, while the latter was a form of sandstone with a certain amount of iron, and was pervious to water. In the valleys the Deccan trap rock was exposed to the surface, and the farther one went from the valleys the laterite crust got thicker. There was no other alternative but to make use of the existing water supply, which consisted of upland surface water. The water was stored in an artificial lake, which was formed by a dam having been built across a valley on the impervious Deccan trap rock. The catchment area was thickly covered with trees and undergrowth, and had bungalows with servants'

cultivators, including princes, built on it, and consequently it was very unsanitary. Owing to the smallness of the landholdings in mist, the compounds of the bungalows could not be compulsorily acquired with the object of razing the bungalows with their outhouses to the ground and excluding the public from the catchment area. The average rainfall was about 200 in. annually, and about 175 in. of this fell during the monsoon months, from about June 15th to September 30th. During the monsoon months, owing to the heavy rain and mist, most of the people left the hill for the plains. The water of the lake had been reported on by the analyst as "non-potable owing to sewage contamination." This report had also been passed on the water collected from the entrance streams of the lake when running at all times of the year, except during the period from shortly after the setting in to the finish of the monsoons, when it had been passed as "a good sample of potable water." The reason for this difference in the analytical report was that, owing to the very heavy rainfall, the sewage and the other filth on the hill got washed away during the early part of the monsoons, leaving the hill quite clean. There was no spring directly opening into the lake, though there was a spring in the valley of the main feeder of the lake, but it was quite 150 yds. above the lake. With these facts before them, the only way of improving the water supply was to keep out of the lake the contaminated water, and to allow into the lake only the non-contaminated water. This could only be done by constructing above the lake on all sides of the hill and across the valleys a wall of solid impervious rock masonry on the imprevious Deccan trap rock, and thus forming a drain to prevent any water from passing into the lake, this wall to be below the spring mentioned. In the valley of the chief feeder stream a double sluice would be provided in the wall, so that if any water escaped through the first sluice it certainly would be stopped from passing into the lake by the second one. He might state that the two sluices referred to would only be opened during the monsoons to allow the water (when it was potable) into the lake. The conclusions to be drawn from the foregoing statement of facts were that the following conditions must be present for this system to be efficient: (*a*) The locality must be subject to seasonal rains like the monsoons. (*b*) In such places during a certain period of the seasonal rains the catchment area must be free from pollution by either the public leaving the hill as in the case in several places in India, or the public excluded from in any way using the area. (*c*) The storage lake or reservoir must have no spring opening directly into it. (*d*) The storm-water drain must be constructed on impervious strata, and thus any leakage into the lake prevented.

Mr. H. PERCY BOULNOIS (Westminster), in proposing a vote of thanks to the reader of the paper, said that without plans and sections it would be difficult to criticise the methods adopted for ensuring pure water. The paper really said nothing about storm-water drains, in spite of its title; the method which apparently was adopted was to shut off the whole of the surface water in the neighbourhood of the lake, and only admit other water, the source of which he could not gather. On the face of it the simplest plan appeared to be to drain the houses and deal with the drainage on modern lines. With a large, scattered population it would have been cheaper than going to the expense of an enormous dam. As we did not have monsoons, this class of engineering did not obtain here, but they were extremely obliged to Major Murison for his paper.

Major MURISON, in replying said Mr. Boulnois could take it from him that they had adopted the cheapest method in constructing the dam, for, owing to the habits of the people, the forest itself was nothing but a public latrine. Drainage, therefore, was next to impossible.

CAMP SANITATION.

A paper on this subject which was next presented by Lieut.-Colonel H. R. KENWOOD, M.B., F.R.S.E., R.A.M.C., is reproduced on another page of this issue. Following its reading, Colonel COPEMAN, while agreeing as to the superiority of the water-carriage system, pointed out that it obviously demanded an ample supply of water. The number of huts at Crowborough made the installation of the system impossible.

Major STOTT expressed surprise that there should be any idea of installing the water-carriage system in camps, having regard to the necessity for effecting economies wherever possible.

Colonel KENWOOD, in his reply, insisted that, in situations where its installation was practicable, the water-carriage system was the cheapest. The matter had been carefully gone into, and the Army Sanitary Committee were unanimous in recommending its adoption wherever practicable.

SEWAGE DISPOSAL: THE FINAL REPORT.

A discussion on the Final Report of the Royal Commission on Sewage Disposal took place on the following day, Dr. Samuel Rideal, F.I.C., and Mr. John D. Watson, M.INST.C.E., chief engineer to the Birmingham, Tame and Rea District Drainage Board, being the first speakers.

Dr. RIDEAL remarked that on February 11, 1913, he had the honour of opening a discussion on the Eighth Report at a sessional meeting of the Royal Sanitary Institute held in London, and that day the council had again given him the privilege of taking part in a further discussion now that the commission had finished its labours, and the whole of its work was before them. The commission was appointed on May 7, 1898, and the Final Report and General Summary of Conclusions and Recommendations was dated February 11, 1915. He found that at their last discussion he expressed the hope that in this Final Report they would find a general index and concordance of the whole series similar to that of Mr. A. J. Martin, who reviewed the earlier work in his book on "The Sewage Problem," 1905. The commissioners had not done this, but Mr. G. B. Kershaw had edited a guide to the Reports, Evidences and Appendices (1915), which very usefully took its place, and which was almost indispensable for those who wished to follow the work of these seventeen years. The Final Report confirmed the conclusions arrived at in the Eighth Report, and was evidently written under Government pressure owing to the war, as it did not submit any fresh conclusions or make any new recommendations. He could not, therefore, in opening this discussion, do better than refer to the views which he had in 1913, and see how far they had stood the test of two years' application to the professional work which had come his way during the interval.

"The principal difficulty will always rest on the vexed question of standards, and, like so many other similar problems, the fixing of a standard or standards by the Legislature will, I am afraid, result in the lowering of the quality of some of our rivers to the average or inferior article, and very seldom have the opposite effect. If Nature demands a river or stream to be fully saturated with oxygen, civilisation should hardly be content with less. The commission admits that the general result of a standard is a levelling down as well as a levelling up, but hopes that the recommendations will, if adopted, generally level up our rivers.

"The flashpoint of oils, the water content of butter, the standards for milk, and so forth, are all instances of this general principle, and to overcome this difficulty we have recommended to us, in this instance, what may be called an elastic standard—that is to say, the general standard for effluents can be relaxed or made more stringent when the volume of the river is considered in relation to the volume of the effluent. This principle undoubtedly is a great advance, as it devises a system whereby a local authority is not required to incur any further expenditure on sewage disposal than will suffice to prevent the occurrence of actual nuisance.

"In order that an authority may avail itself of this elastic standard, it is necessary that the volume of the effluent and the volume of the recipient waters may be accurately known; but I find that neither of these factors are ascertainable with any degree of certainty; so that a third factor or margin of safety must be introduced into the problem, which almost nullifies the advantages which this long inquiry has attempted to secure. The river water of average purity is assumed by the commission to be of such a quality as to take up 0·2 part of 100,000 dissolved oxygen in five days.

"A standard effluent is one which contains less than 3 parts per 100,000 of suspended solids, and takes up not more than 2·0 parts dissolved oxygen per 100,000 in five days.

"Such an effluent, if it mixed with eight times its volume of river water of average purity, would form a mixture which would not take up more than ·4 part in five days, and this is a condition which gives ·6 part of oxygen left in the river at all times and suffi-

cient for fish life and for the prevention of aerial nuisance. There are cases, however, in which the ratio of sewage to river water is less than this, and it would then be necessary to have a more stringent standard. The converse is also true, and calculations are given in the Eighth Report by which it is possible to arrive at the quality of the effluent, and therefore the nature of the purification works required, at any given spot whenever the volume of the effluent and the volume of the river are known. Unfortunately these two figures are exceedingly variable and open to much debate. I know of no case in which either figure can be given with any accuracy, and the variation in the ratio between the maximum sewage flow and the minimum dry-weather flow of the river, and the ratio of the dry-weather flow of the sewage and the maximum or storm flow of the river is so great in the majority of cases that it is impossible to do more than make guesses at the average or probable ratio of these two determining factors. It is also obvious that in the majority of cases storm overflows and storm sewage will discharge into the same river as that receiving the effluent in normal weather, and frequently a local storm will determine these pollutions of the river while it is still flowing under dry-weather conditions, so that the ratio is thereby upset, and calculations based on it are of little avail. I have already had experience of these very serious difficulties in arriving at a conclusion as to the nature of the purification works required in one or two important cases.

"The commission also suggests that these recommendations should be applied to tidal waters, and here the complexity of the problem is considerably increased. Towns on estuaries cannot rely on the whole of the tidal dilution, but rather on the available tidal dilution, which is a very different figure. In fact, it would seem rational to say that in the majority of estuaries in this country the tidal waters are of very little value for purification purposes, and that the only real diluting factor that can be relied on is the minimum dry-weather flow of the river concerned.

"The central authority to be created must draw up a code of instructions or regulations for the guidance of River Boards and local authorities, and it would seem desirable that one of its first duties should be to gauge the rivers of England and fix, as far as possible, what figure shall be considered as representing the flow of the river, or available water for dilution purification, and thus give a guide to the authority as to the volume which may be considered available and suitable for the purposes of sewage purification. In the Appendix to the Eighth Report, p. 176, some river gaugings are given by the commission which show variability of several of our well-known streams. A comparison of Buxton, on the river Wye, and Rugby, on the river Avon, illustrates the difficulty, as these two towns, although very different in population, have rivers whose dry-weather flows are approximately the same. I regard this gauging as far more important and essential than the gauging of the volume of sewage liquor or effluent discharging into a stream, as the amount of oxidation required of the river depends on the strength of the sewage as well as its volume, and as these two factors are inversely proportional to one another, it would seem preferable to ignore altogether the volume of the sewage and its variable strength, and rather base the calculation on the population of the district likely to contribute to the discharge of sewage effluent into the river. Looked at from this point of view we can definitely lay down a law that the population on the banks of a river cannot increase above a certain density based upon the flow of the drainage area available for dealing with its sewage. Sir William Power, in his memorandum to the Ninth Report, has summed up this aspect of the case in saying that it is of essential importance that watershed authorities should definitely be charged with control of volume as well as of quality of water in their rivers. In our last discussion on this subject I ventured to point out the disadvantages, in my opinion, to the suggested standards being based on the rate of absorption of oxygen instead of on the amount of dissolved oxygen that should be found in all rivers at all times. In New York it is proposed to fix a definite oxygen standard for the harbour waters. It seems to me that if the commission had laid it down that a river coming to any place of sewage discharge should be assumed not to be deficient of 20 per cent of the oxygen required to saturate it, and that an offence would be created if any discharge caused a deficiency in the river immediately below of more than 40 per cent of the oxygen required to saturate it, and a deficiency of more than 20 per cent saturation before reaching the next pollution, the suggestions of the commission would be arrived at by a simpler test, and one which could be readily performed. It ought to be easy for a local authority to show that it was doing its duty to the river by a twofold test of this character, and in the event of satisfactory evidence being produced that the incoming river was below the prescribed standard, the authority could then shield itself from additional expense until the central authority or Rivers Board had dealt with the upper waters."

Concluding, Dr. Rideal said that his friend Mr. Watson was to follow in this discussion, and he hoped that he would give them the volume of the Birmingham effluent, the volume of the rivers into which it was discharged, and what standard he would suggest in order that the commission's ruling might be applied to this specific case. Colonel Harding, at their last debate, made it clear that the commissioners had no intention of allowing a relaxation of the general standard in favour of dilution in all cases; otherwise, when dealing with "clean" rivers, the commission suggested that they might be made "fairly clean" to "doubtful," or, in other words, "dirty," but not too dirty. This finding also made it impossible for more than one large-sized town to be on a good many of our rivers, as he would be very much astonished if, when a town had reduced the oxygen content of the river from the 0·2 rate to the 0·4 rate, the river could naturally recover to the 0·2 rate before it reached the sea. It might be as well to draw attention to the wording of the Eighth Report, p. 4, which modifies very considerably the view that the commission had given their sanction to further depletion of our rivers of their useful oxygen. They said, "We do not therefore recommend a system by which the degree of purification required for each separate discharge is determined automatically by the quality and the relative quantity of the water receiving it." A relaxed standard was therefore not to be permitted when a further pollution took place lower down the river. Under the present Rivers Pollution Prevention Act of 1876 the duty was imposed on the local authority of adopting the best practical and available means to render the sewage harmless before it entered the river. Now they were told that harmless could be defined if the river, after having received the effluent, did not lose more than ·4 part per 100,000 of dissolved oxygen in five days at 65 deg. Fahr., and that this standard must be reached even if the dry-weather flow of the river be nil, although an effluent of this character could only be produced by works of a much more elaborate character than any usually built.

Mr. WATSON said the colossal work of this unpaid commission was the admiration of all who were deeply interested in the subject of public health, and particularly of those whose business it was to study and apply the results of their labours and judgment. The volumes which had been issued by the commission from time to time probably constituted the best and most reliable compendium of facts relating to sewage disposal which had ever been collated in England. That the early documents and minutes of evidence were now likely to be read for guidance and help, one might be pardoned for doubting, but this only proved that the science of purification of foul liquids had travelled far since that evidence was given.

"The work of the commission has not been universally accepted with gratitude. This may in some measure be due to the fact that the commission itself has appeared to be somewhat tardy in bringing its labours and recommendations to a conclusion. Especially has this appeared to be so in the eyes of those who have waited for a definite lead before undertaking expensive works. Not unnaturally some local authorities and their officers who have recently constructed contact beds have been disappointed to learn that, in the opinion of the commission, the value of 1 cubic yard of suitable medium as a percolating filter proximated to the value of 2 cub. yds. when constructed as a contact bed. Still critics should remember that haste would have greatly curtailed the value of the report as a whole, and that the commission depended largely upon the experience of others in arriving at a sound judgment.

"I have no doubt that the commission would be the first to admit that their work, even after all these years of labour, is still incomplete, and that phases of the subject worthy of the closest attention are still

uninvestigated, far less decided. This confession prompts the question whether an effort should not be made to establish a permanent research department capable of taking up the work where it has been laid down by the commission. The subject is so complex in its nature that it will not admit of being pigeon-holed as a settled question. We shall soon fall behind as pioneers if some such department is not charged with duties similar to those so ably performed until the other day by the officers of the Royal Commission. As a practical people who have deemed it wise to spend during the past dozen years nearly £20,000,000 on works of sewerage and sewage disposal, we realise that a research department on the lines of the Massachusetts State Board of Health would be of great benefit to local authorities whose responsibilities are ever on the increase.

"The commission's report (speaking of their work as a whole) is the sanitary engineer's magna charta. It has freed him from cast-iron rules which require every scheme of sewage disposal to have irrigation as its leading feature if it would merit the approval of the Local Government Board, an approval absolutely essential to every scheme which depends upon borrowed money for its execution.

"In recommending that each scheme should be judged on its merits, having due regard to situation and the volume of the stream into which the effluent is discharged, the commission has taken a long step forward, one which entirely severs it from any association with the recommendations of former Royal Commissions. Some critics have been bold enough to say that such a recommendation shows want of definiteness and consistency. So far from this being the case, it is in my judgment a direct evidence that the Iddesleigh Commission has realised the difficulties of the subject and the way to overcome those difficulties as no predecessor has ever done. Every other commission seems to have assumed that there should be one, and one only, method of purifying sewage. The work of the Iddesleigh Commission has proved abundantly that there are many methods of attaining the end desired, and that the efficiency of a scheme is not to be judged by the effluent produced, irrespective of the volume and condition of the stream into which it is to be discharged. It has at last been recognised that there is just as little merit in producing a high-class effluent which is discharged into a great river as to produce an inferior one and discharge it into a trout stream.

"Very few local authorities have been conscious of the anomalous position in which their advisers have been put when charged with the duty of designing sewage purification works. It is no doubt assumed that the scheme which is put before a local authority by an engineer is capable of complying with the requirements of the Local Government Board, and of being so constructed and worked that it will comply with the Public Health Act. I venture to say that there are few local authorities in England capable of complying with sec. 17 of the Public Health Act, although there are hundreds of authorities who have been lulled into that belief by the fact that their modern sewage works have met with the approval of the Local Government Board. For many years that board has passed schemes on condition that a volume equal to three times the dry-weather flow is treated so as to free the liquid from the solid matter of sewage—in all, six times the dry-weather flow is treated so as to free the liquid from the solid matter of sewage—in all, six times the dry-weather flow before the effluent is discharged into the stream; but the law makes no allowance for the local authority being obliged under any circumstances to discharge a sewage effluent into a stream if that sewage effluent is inferior in quality to the stream itself. The report of the Royal Commission proposes to sweep away such anomalies, not necessarily by dealing with them specifically, but by creating a central board possessing adequate technical knowledge and power to determine all disputes relating to the quality of sewage effluents.

"The creation of Rivers Boards, with a paramount central authority, forms one of the chief features of the commission's leading recommendations. The proposal to set up new rivers authorities, implying change and interference with county councils who have efficiently discharged their duties as conservators of rivers, has not by any means received universal approval. On the other hand, the proposed central authority has been regarded by everyone who has cognisance of the difficulties surrounding the subject of river pollution as an excellent and statesmanlike recommendation

"Alongside this recommendation there is a proposal to set up a statutory standard of effluents. As nearly every Royal Commission has made similar recommendations, one cannot associate the word revolutionary with the suggestion; still it is in one respect revolutionary, inasmuch as it proposes to do what experts of experience regard with the gravest concern.

"It is not that a standard for effluents is unnecessary, nor is it that the standard of purification proposed is too high; it is the proposal to make it *statutory* that is the obnoxious feature. It is not enough to say that the central authority would have power to free a local authority from its legal obligations. If it were wrong for a town like Llanrwst to spend public money on the complete purification of its sewage, and afterwards discharge the effluent into a river 2,000 times the volume of that effluent (and the Royal Commission would be the first to say it was wrong), it would be a humiliating position for that local authority to be obliged to ask for a whitewashing order for only doing its duty. Still, we must guard against magnifying the proposal to erect what Colonel Harding called a statutory normal standard into an unpardonable offence.

"I think it will be found practicable to realise the ideals of the commission without raising the susceptibilities of local authorities, if it is admitted that there can be no two cases precisely similar, and that, consequently, however unsatisfactory it may appear, there must be a great variety of standards.

"Could not a rivers authority make by-laws relating to sewage purification in their watershed which would be as binding upon individual local authorities (after they are endorsed by the proposed central authority) as by-laws framed by boroughs and afterwards countersigned by the Secretary of State for the Home Department for, say, the use of public parks?

"In considering this question it is impossible to ignore the differences in the character of the sewage effluent, which manifest themselves at every turn. The strength of the sewage varies with every hour in some cases, and the volume, especially in small installations, fluctuates considerably, rendering it most difficult to get a chance sample of the effluent which corresponds with an average sample made up of half-hourly samples taken over the twenty-four hours. It is known to every expert that neither bacteria bed nor irrigation field yields effluents of uniform quality. Consequently if a standard is fixed, it must be fixed with this knowledge; otherwise it must lead to either unnecessary laxity or unnecessary stringency, both of which are objectionable. Again, seasons must be taken into account, as it is unreasonable to expect a purification plant to give as good results during a time of abnormal cold as it would during a normal temperature. If such a plant were large enough to produce an excellent effluent in mid-winter, and capable of complying with an average standard, such as a statutory one would have to be, it would be too large and unnecessarily costly to meet the demands of the statute at other seasons of the year.

"This question was very carefully considered by a committee of experts appointed by the Association of Municipal Corporations, called into being after the issue of the Eighth Report of the Commission. The committee met periodically during the spring and summer of 1913, and unanimously came to the conclusion that it was not desirable that standards of purity should be prescribed by Act of Parliament. It is impossible in the time at my disposal to refer to reasons which induced this committee to come to this conclusion, but *inter alia* they stated that 'Any amendment of the law should be to improve or conserve the condition of the rivers, and not to compel municipalities to discharge sewage effluents of uniform quality. The authority of the central authority should be paramount, and every municipality should be obliged to accept their dictum as to what is necessary; not, however, until a careful and unbiassed inquiry into all the circumstances of each case has been made. As the judgment of the Local Government Board in reference to size and form of tanks, capacity of bacteria beds, &c., is now accepted, so should the decision of the central authority be accepted in all matters relating to the pollution of rivers; and as the Local Government Board have power to vary their requirements as a condition of sanctioning a new loan, so should the central authority have power to vary their requirements as a condition of assuming responsibility for allowing effluents to enter a stream.'

"If the recommendation of the Royal Commission to set up a paramount authority relating to questions

of sewage disposal be given effect to, care should be taken to see that harmony obtains between the engineering department of the Local Government Board and the advisory department, which would be represented by the central authority; otherwise local authorities might be called upon to construct sewage works of a size and power which would not harmonise with the requirements of the case as judged by the central authority, who would have the advantage of judging completed works by their ability to produce an effluent sufficiently good to meet their view of the requirements of the case. Here, again, however, it would be a mistake to emphasise differences which are quite capable of being solved when the duty of preparing a new Public Health Bill comes to be undertaken."

In conclusion, Mr. Watson said that before the law was altered he thought it would be well to consider whether the recommendations of the commission regarding Rivers Boards were as comprehensive as they ought to be. The need for economising, which would manifest itself very strongly even before the war was over, induced him to suggest that a rivers authority, with executive as well as administrative power, might be able to improve the rivers of the watershed under its jurisdiction without undue cost if it had power to harmonise the work of the various local authorities in the watershed so as to bring about a homogeneity, which at the present time was conspicuous by its absence. They were indebted to the Iddesleigh Commission for the freedom of action which had for the most part obtained since their Fifth Report was issued, and he thought it would be well, if it were practicable, to go a step beyond any of their recommendations and give to rivers authorities power to adopt something in the nature of the Water of Leith Purification Act, under which a drainage district area was formed to free the water of Leith from pollution, and by which power was given to the river authority to assess the whole district on both sides of the stream for the cost of constructing and maintaining the works necessary to effect the desired improvement. That, however, enters upon a subject too wide to be disposed of in one sentence.

Mr. C. H. Cooper (Wimbledon) said he thought they must all feel indebted to the authors of the two papers. Both were experts in the subject. As one who was concerned with sewage treatment from the engineering point of view, he felt very grateful to the Royal Commission for setting forth the difficulty of getting satisfactory decisions from the courts of law as at present constituted. The suggestion for a central authority was most valuable; at the same time, such a body, in his view, should not be independent, but part and parcel of the Local Government Board. As regarded the work of the commission, they dispelled the idea that it was necessary to have land treatment. Attempts were made to grow crops and at the same time cultivate bacteria for treating sewage—which was quite impossible, for the crops were only able to take sewage at various periods, whereas the bacteria required a constant supply of air and sewage to maintain them. The same thing occurred with contact beds. In that case they had got to maintain the supply of oxygen to the beds, at the same time as they attempted to supply them with sewage. That, in his humble opinion, was a combination which would very soon have to be abandoned. In the percolating beds they maintained their supply of oxygen and sewage to the microbes, so that work could go on continuously—and the whole thing went on more satisfactorily. As regarded the condition of the river above the works, that was altogether wrong. Take the case of Birmingham; why should the people of Tamworth and other places lower down have to submit to the river being in the condition that it was? If a Rivers Board went to places above Birmingham and told them they must improve the condition of their effluents, the authorities would say, "What is the good, when Birmingham is discharging an effluent that is absorbing something like 4 parts of oxygen per 100,000?" It appeared to him to be a very strong argument. There was one difficulty in the appointment of these Rivers Boards. In many instances the greatest offenders—the large towns—had a predominance of members on these boards, and the consequence was that each district looked after itself, and was not so much inclined to be as hard on their own authorities as on the smaller authorities. London was discharging storm water into small streams and polluting them to a very large extent. That was a thing which was very hard to get rid of, and ought never to have been allowed. The idea of the commission of discharging untreated tank effluent into a stream—however big that stream might be—seemed to him to be wrong, and the commission itself showed the danger. Untreated tank effluent was nothing else than a portion of the raw sewage. Mr. Watson was perfectly right in his view that the researches instituted by the commission should be continued. Since the commission had ceased its work the very important question of activated sludge had come to the fore, and, personally, he thought it was a method of treatment that in all probability would become a practical one before long. The Rivers Boards of this country had got into a very bad state from two points—that of pollution and as regarded the prevention of flooding. It was a disgrace that our rivers should be in the condition they were. As to the question of samples, the majority of the county councils and the persons who took analyses denied to the local authorities copies of the analyses. Very few local authorities analysed samples themselves, and it would be most useful to them to have the results. The Port of London Authority actually denied the right of anyone to be furnished with their analyses. The Mersey and Irwell and West Riding Rivers Boards, on the other hand, were compelled to divide their samples in the first place and furnish samples in those cases where they intended to prosecute. Those boards were of the greatest assistance to the authorities and manufacturers who discharged into the streams; they assisted them to improve effluents, whereas he was afraid that in a good many cases the main object of inspectors was to get as bad a sample as they possibly could.

Mr. A. P. I. Cotterell (Bristol) said the readers of the papers had approached the subject from two different points of view, and their remarks therefore became all the more valuable. Both gave their thanks to the Royal Commission for their enormous labours and for the huge quantity of standard information which had been accumulated by them for the use of engineers, chemists and others interested in the question. He very much appreciated the remark of Mr. Watson that the essential principle of the Final Report was that each scheme should be judged on its own merits. That, he thought, they might take as the bed rock of the reports, and it was one he was very grateful for, inasmuch as it relieved them from the cast-iron methods of former days. The Royal Commission proposed as their instruments in carrying out that recommendation two different authorities—one the central authority and the other the local Rivers Board—and he thought they must keep in mind those authorities when they thought over the criticisms of Dr. Rideal upon the recommendations of the report. They were, he conceived, an essential feature of the recommendations, and without them he did not apprehend the commission would have made the suggestions as to standards and other things they had done. They made the suggestion—referred to by Mr. Watson—that legislation should be amended. All, he thought, would agree that legislation on the lines of sanitary improvement was very much belated. Mr. Watson brought that out very prominently when he said, "I venture to say that there are few local authorities in England capable of complying with the 17th section of the Public Health Act, although there are hundreds of authorities who have been lulled into that belief by the fact that their modern sewage works have met with the approval of the Local Government Board. For many years that board has passed schemes on condition that a volume equal to three times the dry-weather flow is treated completely, and that an additional volume of not less than three times the dry-weather flow is treated so as to free the liquid from the solid matter of sewage; in all, six times the dry-weather flow before the effluent is discharged into the stream; but the law makes no allowance for the local authority being obliged under any circumstances to discharge a sewage effluent into a stream if that sewage effluent is inferior in quality to the stream itself. The report of the Royal Commission proposes to sweep away such anomalies. . . ." They all knew what those anomalies were, and although they agreed safeguards must be given to those who safeguarded our streams, the law as it stood merited the remark that it "is an ass." If they did adopt standards for sewage effluents as recommended by the report they were not doing more than had been recommended for many years. Was there a single properly managed sewage works in the country that was not looked after by its own officers from the point of view of standards? Storm-water overflows needed more treatment. Too often these were a convenient back door, and there was no reason why there should not be treatment

The Surveyor
and Municipal and County Engineer

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sufficient to prevent pollution of rivers. Undoubtedly the question of river flows was of the very greatest importance, and it had been considered as of import- [illegible] by engineers in relation to the [illegible] He knew that the flow of all rivers varied at different times of the day, but they could, by allowing sufficient elasticity, meet the conditions in a river at its worst period. It might be necessary more fully to purify the sewage at one time of the year than another. They could adjust the effluent according to the population that lived on the banks. They must take the degree of purification into account. He did not think there was any great difficulty in dealing with tidal flows in the same way as the river flow; in fact, it was easier. It became really a question of bulk dilution. They could calculate absolutely what the bulk of water was according to the height of the tide, and a river flowing into it made no difference—it only helped to make up the bulk. When they came to normal times it would be absolutely necessary to reduce considerably any unnecessary expenditure, and they would have to fall back more on the wealth represented by the human brain. They would require to make use of every bit of scientific knowledge they possessed, and to relax many of the standards they had hitherto set up, and make manufacturers take more care of their waste products. It was no use telling the public to-day that certain high standards must be maintained. They would have to meet the altered conditions, and if they used their brains and common sense they could do so with advantage to the country, and with improved scientific results.

Mr. W. T. BURGESS (London) remarked that they were all looking forward to the early formation of the suggested central authority.

Votes of thanks afterwards brought the proceedings to an end.

NEW RECREATION AND PLEASURE GROUNDS AT ST. AUSTELL.

The recreation and pleasure grounds at St. Austell, presented to the town by Admiral Sir Charles Graves-Sawle, Bart., were opened by the donor on August 12th last. At the same time the bandstand and shelter, given by Sir Francis Layland-Barratt, Bart., was opened by that gentleman.

The grounds have been particularly well laid out to the designs and under the supervision of the engineer and surveyor, Mr. E. D. GROVES, M.I.M. AND CO.E., and in years to come, when the trees and shrubs have had an opportunity to grow, will be a pretty and ideal place.

The main entrance is from the newly made road, and a wide promenade, with borders on each side, leads to the bandstand formed by the railed-in top of the shelter which overlooks the ground, and on which seats are placed.

The slope between the new road and the ground has been converted into terraces, banked with shrubs. A gracefully sloped path leads down to the ground, the sides of which are planted with trees and shrubs.

The shelter, which is also the design of the surveyor, occupies a central position. The roof, which forms the bandstand on the promenade level, is supported on three cast-iron columns, and is of reinforced concrete. The seats, panelling, and other wood work are of teak.

ST. AUSTELL'S NEW RECREATION GROUNDS

At each end of the shelter, and under the same roof, public conveniences are provided. The men's section is provided with one two-stall urinal and two water-closets, and the walls are finished with white glazed tiles. Two water-closets are provided in the women's convenience, and finished similar to the other.

The greatest portion of the ground is grass, divided by gracefully curved paths, the lower side being banked off. Swings, see-saws, &c., will be fixed on the latter portion.

Bedwellty Water Supply.—The new pumps and reservoir tanks for the supply of water to Phillipstown and other high levels of the Bedwellty Urban District were formally opened on Tuesday. The tanks, with the pumping apparatus, have been installed at a cost of £6,500. Gelliwell reservoir has a capacity of 240,000 gallons, and the supply is being pumped from the Rhymney and Aber Valleys main service at Brithdir to a height of 1,140 ft. above sea level, and from this point is conveyed by gravitation to the newer and higher altitudes of Phillipstown, above New Tredegar.

Tarmacadam Work in the County of Clackmannanshire.

We [illegible] that we believe will [illegible] a cost [illegible] of the [illegible] of the road-[illegible] at the county depot at Clackmannan, here. Said [illegible] Mr. Thos. C. Allood, the county surveyor, [illegible] our representative with the details, and [illegible] some interesting figures as to costs, and we would [illegible] direct attention to the fact that no young men are employed, the average age being over fifty-seven years. This has only been possible owing to the careful way in which the plant and general arrangements have been planned by him, and the county is certainly [illegible] congratulated on the general efficiency [illegible]

bouring quarries which supply the rubble and other metal for the roadwork, and which would also shorten the journeys of the tractors to reach the chief roads of the county.

Eventually the present depot, known as the Bankhead stone depot, was set up, this occupying a 2-acre field alongside the North British Railway, Devon Valley line, at Bankhead, about ¾ mile to the west of the old depot. There was an old disused railway line running across this field, and, owing to certain mining operations years ago, the ground sloped in different directions from the embankment of the rail

STEAM CRANE AT CRUSHER PLATFORM DELIVERING BARREL.

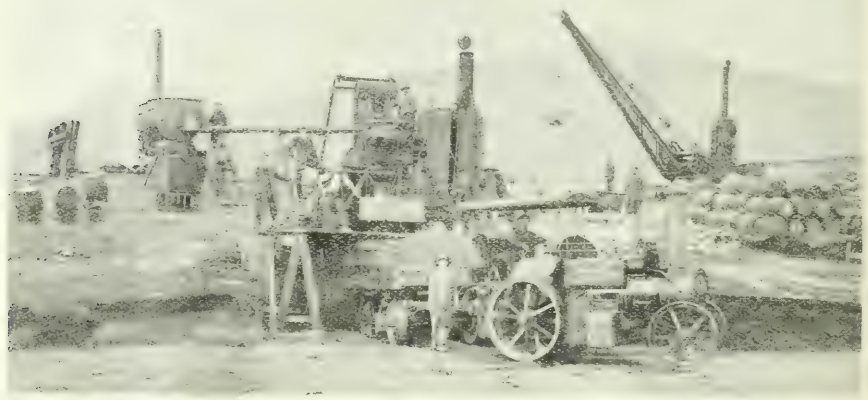
The arrangement of Koehring hot mixer and tar-boiler, and the hauling out of loaded trailer, and the empty trailer going into position for refilling.

and low cost of production, especially in view of the natural difficulties to be contended with and the good wages paid.

We trust this account may be of some service to other surveyors, and it certainly proves that there is no need whatever to employ men of military age on this class of work.

The county council have recently abandoned their [illegible] depot, which was situated at the west end of

line, and thus offered admirable facilities for the installation of machinery and plant owing to the various levels obtainable, which is always a desirable feature in setting up plant, and particularly of the type used in road material manufacture. The platform of the stone crusher in use is a foot above and to the south-east end of the embankment. Below the crusher screen are fitted hoppers which are only used when the broken metal is to be stored for future use. In



CRANE CONVEYING TAR BARREL TO BE PLACED ON BOILER.

Mate and boiler on line to tip stone into Koehring machine bucket, and tractor in position to haul out loaded trailer.

Tillicoultry, a town lying on the southern slope of the Ochil Hills, which form the northern boundary of Clackmannanshire. The isolation of this old quarry from the neighbouring ones, together with the natural barriers surrounding it, which caused long detours to be made in order to reach the principal highways of the county, and the fact that the townsfolk had complained of the incessant stream of heavy traffic passing through the town, were responsible for the council deciding to look around for a spot more central which would be within easy access to the neigh-

addition to the hoppers there is a shoot with folding doors, spaced at every 2 ft., down which the metal slides and fills at any point the trailer standing below. When the shoot is required the upper portion of the shoot is formed by lifting the plate side of the hopper nearest the shoot; this, when dropped, forms the side of the hopper. The metal from the crusher drops into small trucks which run along a 2-ft. gauge bogie line to the loading bucket of the Koehring hot mixer, into which the metal is tipped for the manufacture of tar or any sort of macadam desired.

As the manufacture of tar-macadam was not contemplated when the plant was set up, it was necessary to devise some arrangement to mix the various sizes of metal for this purpose. This was accomplished by carrying out a new hopper from the side of the existing hopper to take in the three sizes—viz., 2½-in., 2-in., and 1½-in. to 1-in.—in the shoot where the metal drops into the end of trailer and discharge the contents into a bogie on a side line. This arrangement worked very well, not interfering with the [illegible] in the new hopper, when thrown back, allowed the metal to drop freely into the end of trailer as before. When the treated metal from the Koehring mixer has filled one trailer the steam motor-lead slips on to the next and in

Boiler in Position after Tipping Stone into Koehring Machine Bucket

The tar boiler with can for hot tar formed of house chimney and measuring box, the driver in the act of raising the bucket

empty trailer is placed in position, while the loaded one is hauled to the road, emptied, and returned.

The North British Railway have laid a siding on the north side of the west field with enough track to hold twelve wagons comfortably. Parallel to this siding, about 12 ft. above it and 21 ft. from centre to centre of rails, a 4-ft. 8-in. gauge line has been laid down on which travels a 2-ton steam locomotive crane having a 21-ft. sweep. This crane lifts all rubble out of wagons by means of iron boxes with bottoms worked on the trigger principle, and delivers it either on the bank or at the crusher when work is in progress. The whole of the unloading and delivery work is performed by the crane driver and one man. The crane is also able to run along the rails to the coal shed and deliver coal where required.

After work had been in progress some time it was found necessary to have the Koehring hot mixer set up on another level for the manufacture of tar-macadam. As stated above, the formation of the ground lends itself admirably for this purpose. The position finally decided on was the further end of the bogie line from the crusher, the Koehring loading bucket being just below the level of the rail to enable its being fed direct from the crusher by a tipping bogie. This position ensures the metal from crusher being quite clean, and allows the Koehring machine to be well away from the dust and other particles likely to affect its easy working—this being a most important precaution with this type of machinery.

The hot mixer was set up on two concrete walls, and on the discharge side of mixer the soil was cut away to a depth of 9 ft. to admit a trailer to be backed under the small platform on which was a small bogie which received the tarred material from the discharge chute, and then tipped the contents into the trailer beneath, thus saving much time and labour usually expended in shovelling the material into wagons or trailers.

The tar used in the manufacture of tar-macadam is boiled in a 200-gallon capacity tar boiler, set up on the end of the crane line, and packed up high enough to allow the boiling tar to run down a 25-ft. chute with a slope of 9 in. in this distance, into the measuring tank of the Koehring machine, and when ready the required batch of tar was run direct into the mixing drum. The crane fed the boiler with tar barrels, and also lifted up the barrels of fuel oil for the oil furnace on the Koehring machine, and placed them alongside the engine ready to be strained before allowing the oil to enter the fuel tank.

By the thorough organisation of this plant the whole process of receiving the rubble in the wagons in the siding, delivering it at the crusher, making correct-size metal, conveying it to the Koehring mixer, converting it into tar-macadam, delivering into trailers for dispatch to the roadside, goes on continuously, no one part having to wait or being dependent on the other.

General View of the Whole System

Showing muckle stored on loading bank and metal stored in the metal shed below

We believe it will be very interesting for readers to know the amount of labour required in the whole process, including the conveying, laying, spreading and rolling of the tarred stone on the road, and we give the surveyor's figures herewith:—

One crusher engine driver, who fills up his spare time helping at the jaws.

One man at the jaws of the crusher.

One man at the hoppers, and one man to help him with bogie.
One man at the shoot.
One engine driver at the Koehring machine making tar-macadam.
Two men at box taking delivery of tar-macadam.
One man attending to the fires and water.
One man at the tar-boiler attending to temperature and supplying tar.
One driver on the tractor.
One roller driver and four men spreading metal.
One crane driver and man.

With this arrangement and the valuable assistance of the crane it was found that able-bodied men could be dispensed with to a great extent, and the number of men reduced 50 per cent, these being very essential points just now. One thousand tons of tar-macadam work was done recently at the council depot by this number of men, whose ages were as follows: One, 78 years; three, 72 years; five, 65 years; two, 60 years; one, 55 years; four, 50 years; one, 35 years; in all, eighteen men—*i.e.*, four drivers and fourteen labourers.

Mr. Alford gave us the details of a day's (nine hours) work from the receipt of the rubble in the siding, the manufacture of tar-macadam by the Koehring hot-mixing machine, the conveying out of the tarred stone, and laying and spreading and rolling on surface, finished, as follows:—

NINE-HOUR DAY.

The steam crane conveys to crusher 50 tons of rubble.
The crusher makes 40 tons of metal, 5 tons chips, and 5 tons dust.
The Koehring tar-mixer makes 40 tons of tarred stone, but is capable of manufacturing 60 tons in nine hours if fully worked. The output is limited to the supply in this case.
The tractor conveyed a distance of 2 miles 40 tons of tarred stone.
The roller rolled in 40 tons of tarred stone chipped over.

The cost of the day's work:—

	£	s.	d.
Cost of rubble, 40 tons at 3s. 5d.	6	16	8
Wages of crane driver per day		4	10
,, loader per day		4	5
,, crusher engine driver ..		4	5
,, man at jaws ..		4	5
,, three men at hoppers and screen		13	3
,, Koehring driver		6	10
,, four men at Koehring		19	8
,, one tractor driver ..		7	0
,, one roller driver		4	10
,, three men with roller at 4s. 2d. each		12	6
,, one night watcher ..		3	0
Cost of 336 gallons of tar	5	9	0
For all the engines—			
Cost of 1¼ tons coals	1	10	0
,, oils, fluid, 15 gallons		4	6
,, ,, paraffin, 8 gallons		4	10
,, ,, cylinder		1	2
,, ,, compound ..		1	8
,, ,, machine			6
,, ,, grease		1	3
,, ,, waste		1	6
2 tons of ¾-in. chips for spreading, at 4s. 6d.		9	0
Cost of wear of tools for spreading on road		3	0
Wear and tear of all machinery		10	0
Gloves and overalls for men at tar		4	0
Contingencies	1	17	9
Total cost of one day's work ..	£22	0	0

The superficial area of road, 2 miles from place of manufacture, treated with 40 tons of tar-macadam turned out under the system adopted in the county, is 320 sq. yds., at a cost of £22, which works out at 16½d. per square yard. This is not allowing any credit for the 5 tons of whin dust manufactured daily, which will be used as a binding material for the ordinary water-bound macadam road.

MACHINERY.

The 2-ton steam crane (portable), with rails, was supplied by Messrs. Butters Bros., Glasgow, engineers.

The crusher was supplied by Messrs. W. H. Baxter, engineers, Leeds, about twenty-eight years ago, and is still very servicable.

The engine driving the crusher is about twenty years old, and the motor steam tractor has been in use for nine years. Both are still quite serviceable. The 12-ton steam roller has been in use for thirteen years and is still quite serviceable. These three engines were supplied by Messrs. Aveling & Porter, and the fact that they have been so long in use and are still serviceable, and likely to be for many years to come with ordinary care, speaks highly of the quality of that firm's work.

The Koehring hot-mixer machine was purchased in August, 1914, and was used on the roadside last year for the manufacture of tar-macadam for the road improvement work of that year, which was done expeditiously and well. The advantage in using it in its present ideal position reduced the number and quality of labour that was required to work it on the roadside. The number of men employed on the roadside was thirteen, while four men—and not necessarily able-bodied men—can do the same work in its present position.

The county surveyor speaks very highly of the Koehring hot mixer, as it does its work most efficiently, and he stated that he did not see how the manufacture of tar-macadam as done by it could be improved upon. With the present arrangement of having the tar boiler in an elevated position the process is as clean as it is possible to make it; in fact there is no visible sign that tar-macadam is being manufactured till the stone is ejected from the drum into the bogie, which passes over and delivers it into wagon. Mr. Alford further stated that he was more than satisfied with the hot mixer, and that his expectations have been fully realised.

We have no doubt that our readers, and particularly road engineers, will be interested in this record of work done in a very difficult district, and with such success as regards cost and the type of labour used.

TOWN PLANNING IN SCOTLAND.

TENEMENTS AND SINGLE-ROOM HOUSES.

At the annual congress of the Incorporated Sanitary Association of Scotland, held at Glasgow last week, Mr. William Ross Young, town planning engineer, Lanarkshire County Council, read a paper on "Sanitary Provisions being Inserted in Scottish Town-planning Schemes." Considering the present rate at which the movement was proceeding, he said, there was reason to believe that in a comparatively short number of years most of the land encircling our growing cities, towns and villages would have become subject to the control of town-planning schemes. It was feared that those dense rows of high tenements which were being erected in our cities in a more or less haphazard way would before many years have grown into areas as difficult to deal with as their predecessors. We had not yet adjusted our laws to meet the conditions arising out of the upheaval caused by the removal of our rural population to the cities and towns. Mr. Ross Young further dealt with matters pertaining to building which the provisions of the Act governed, and contended that the measure would set our housing system and town development on an entirely new basis. It would ultimately place on a much higher standard the whole sanitary conditions pertaining to communal life.

Mr. A. H. Campbell, burgh engineer, Edinburgh, put in a plea for the spurring up of the application of the Act in all the areas over which they had some measure of control. Tenement planning, especially in the older cities, should receive more attention.

Mr. P. C. Smith, burgh engineer, Dunfermline, maintained that the procedure of the Act must be simplified if it were to become a success in Scotland.

Mr. T. K. Roddan, chief sanitary inspector, Dundee, thought the time was not ripe for abolishing the single-room house. To do so would be a hardship on many poor people.

In submitting a paper on "The Planning of Houses for the Working Classes with regard to the Disposition of Sanitary Fittings," Mr. Joseph Weekes, burgh surveyor, Irvine, said that in the meantime indications pointed to our local authorities having to tackle the housing problem themselves, as private enterprise was not keeping up with public needs. Their first consideration should be to see that even the poorest classes were provided with thoroughly healthy houses.

Qualifications of Sanitary Inspectors.—At the annual general meeting of the Incorporated Sanitary Association of Scotland, Mr. Duncan Campbell, county sanitary inspector, Renfrewshire, proposed the following resolution: "That this annual general meeting of the Incorporated Sanitary Association of Scotland remits to the council of the association to consider the question of present conditions attaching to the appointment by local authorities of sanitary inspectors, and to take such steps as they may deem advisable with the object of securing that no unqualified person be appointed to the office of sanitary inspector." He said that for some time there had been complaints as to several appointments. The time had come, he thought, when the certificate of that association or of some similar body should be of some importance when appointments were made. In the North of Scotland, particularly, they had complaints that men without certificates and without real experience had been appointed sanitary inspectors. The resolution was unanimously adopted.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

499. Geodesy.—Describe generally (without details) the astronomical observations needed to locate the starting-point of a survey in a new country. (E. P. C., *Birmingham.*)

500. Sewage Tank.—A sewer discharging into a sea outfall is connected to a storage tank l feet in length, b feet in breadth, and h feet in height. The tank discharges directly into the sea by means of an orifice a square foot in area, connected to low-water level by a short pipe of the same area, the top of the tank being at high-water level. Neglecting losses due to friction, and assuming that no sewage is admitted to the tank during the period of emptying, that the tide has a range of r feet, and that the tide curve is harmonic, find approximately the time taken to empty the tank. (Stud.Inst.C.E.)

501. Ventilation.—In designing a system of ventilation for a public hall, what are the relative advantages of a small number of large inlet shafts, compared with a large number of small shafts; and at what level should these inlets be placed? (C. W. P., *Wellington.*)

502. Theory of Beams.—The cross-section of a beam is T-shaped, the upper table is 6 in. wide and 1 in. thick, the vertical web is 5 in. deep and ¾ in. thick. At a certain cross-section this beam is subjected to a known bending moment. Make a careful sketch to show the distribution of the stress across the section produced by this bending moment. (C. W. P., *Wellington.*)

503. Sewer Construction. AB and CD are two 18-in. stoneware pipe sewers, intercepted at right angles by a railway in a cutting with slopes of 1 in 2. The fall of AB is 1 in 140 and CD 1 in 360. The invert level of B is 122·5; C=120·75; ground level 128·0, and level of railway metals 106·50 ft. above ordnance datum. Distance from B to C is 110 ft. Describe and show by sketches in detail how to connect the sewers AB and CD, showing provision for cleaning and inspection. The fall of both sewers is towards D. The railway company will not allow any sewer to pass underneath the railway unless at a greater depth from top of sewer to top of rails of 4 ft. (E. H., *Walsden.*)

REPLIES TO QUESTIONS.

498. Buttress Design.—Thirty feet (30 ft.) above the ground a rectangular buttress bears a thrust of 5,000 lb. inclined at an angle of 45 deg. If the buttress is to be 3 ft. wide, and is built of masonry 140 lb. per cubic foot, find its thickness. Also find the height of a turret 3 ft. by 3ft. necessary for stability at the top joint if the coefficient of friction=0·60. (E. P. C., *Birmingham.*)

Let x = the thickness of buttress, and consider 1 ft. of its width. Since the width of the buttress is 3 ft., the thrust on 1 ft. width = $\frac{5000}{3}$ lb., and the weight of 1 ft. width of buttress = $30x \times 140$ lb. = $4200x$ lb. These are the only two external forces acting on the buttress, and they have a resultant R which for stability must cut the base line of the section at some point. In order that no tension may be induced in any part of the structure the resultant thrust R must lie within the middle third of the base (*i.e.*, the resultant must cut CD at not less a distance than $\frac{x}{3}$ from D).

Taking moments round E the mid point of DC through which the weight acts we have

$$R \times \frac{x}{6} = \frac{5000}{3}\left(30 - \frac{x}{2}\right)\sin 45$$

$$\therefore R = \frac{7070}{x}\left(30 - \frac{x}{2}\right)$$

Taking moments round C $4200x \times \frac{x}{2} + \frac{5000}{3}\left(3 \times \sin 15\right)$

$$R \times \frac{2}{3}x$$

Substituting for R $2100x^2 + 35350 = \frac{2}{3}x \times \frac{7070}{x}\left(3 - \frac{x}{2}\right)$

$$2100x^2 + \frac{7070}{3}x = 10650$$

$$3x^2 + \frac{1010}{3}x = 15150$$

$$x = \frac{-\frac{1010}{3} + \sqrt{113344 + 18180000}}{600}$$

$$= \frac{33636 + 4277}{600}$$

$$\therefore x = 7{\cdot}68 \text{ or } 6{\cdot}56$$

The positive value is the required value of x.

∴ thickness of buttress = 6·56 ft.

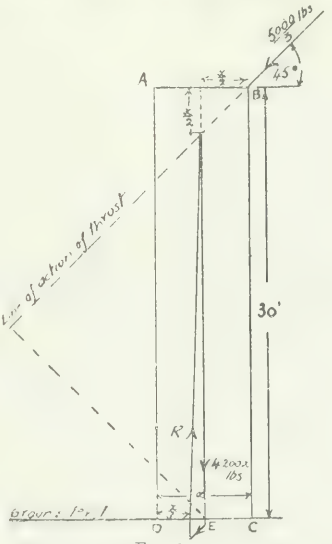


FIG. 1.

Find the height of turret.

Let it be assumed that the turret has to withstand a wind pressure of w lb. per square foot.

Considering 1 ft. width of turret of height y, and let us examine the stability of the turret due to (1) its own weight and (2) wind pressure. Treating each separately,

(1) We have weight of 1-ft. section = $3y \times 140$ = 420 lb., and this is uniformly distributed over its base of 3 sq. ft.

∴ the intensity of compressive stress at the edges D and C = $\frac{420y}{3}$ = 140y lb. per square foot.

(2) The turret may be considered as a cantilever beam fixed at one end, and loaded uniformly with a wind pressure of w lb. per foot-run; then the bending moment = moment of resistance.

$$\frac{wy^2}{2} = \frac{1}{6}fbd^2$$

where b = breadth,
d = thickness of turret,

$$\frac{wy^2}{2} = \frac{1}{6} \times 140y \times 9$$

$$wy = 420$$

$$\therefore y = \frac{420}{w}$$

∴ the height for stability $= \frac{420}{w}$ ft.

If there is to be no tension in any part of the structure there must be a tensile stress at C of just 140y lb. per sq. ft. to negative the compressive stress of 140y lb. per sq. ft. at the extreme edge C in Fig. 2.

$\therefore f = 140y$.

. . . if the resultant thrust is to fall inside the middle third of the base with a wind pressure of, say, 28 lb. per square foot, the height should not exceed $\frac{420}{28} = 15$ ft.

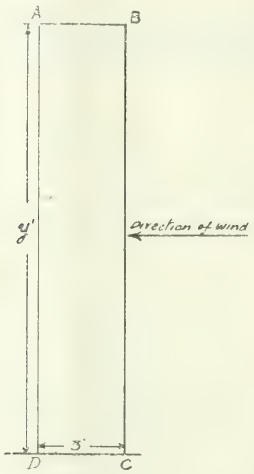


Fig. 2.

Let us now examine this height as regards shear at the top joint.

x × weight = shearing force = 15 P
where P = wind pressure per sq. ft.
$6 \times 140 \times 3 \times 15 = 15$ P

$\therefore$ P = 252 lb. per sq. ft.

So this turret could withstand a wind pressure of 252 lb. per square foot; so the turret is perfectly safe as regards shear. (J. G. W., *Downpatrick.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Burton T.C. (September 7th. Mr. R. C. Maxwell). —This was an inquiry concerning the application of the corporation for a Provisional Order empowering them to run omnibuses and motor cars within the borough. The town clerk, Mr. J. B. Chapman, stated that by the corporation's Act of 1901 they were permitted to run omnibuses and motor cars in connection with the corporation tramways when the running of the latter was impracticable, and the local authority now desired to remove these restrictions. The corporation had been approached from time to time as to the extension of the tramway system, particularly along the Derby-road and the Shobnall-road. The council had been petitioned to run a service of motor 'buses to serve the Shobnall-road district. It was stated by the mayor that it was not proposed to have anything more than an experimental service—possibly two or three cars. It was not proposed to do anything during the war. Mr. T. Hall, borough electrical engineer, said he favoured the electric 'bus. The capital expenditure on such a vehicle was about £1,200, as compared with £6,000 per mile in the case of laying tramway tracks and providing a car. The electric 'bus would carry its own electricity, and have charging stations at the depots at the end of the tramway routes. The speed would be about 12 miles per hour, and about six up-gradients of 1 in 10. The special features of the system were the economy, the very sound running, and the general cleanliness and simplicity. The 'bus would last ten years. In a certain town £500 was paid for petrol for one car annually, while the cost for electricity was £365. Mr. Hall added that his present staff would be able to carry out the work.

APPLICATIONS FOR LOANS.

Coventry T.C.—£80,088 for the electricity undertaking.

Hartismere R.D.C.—£143 for sinking public wells.

Watford U.D.C.—£247 for works of sewerage.

LOANS SANCTIONED.

Cleator Moor U.D.C.—£7,000 for the purchase of land for workmen's dwellings.

Forehoe R.D.C.—£160, supplemental loan for workmen's houses.

Lancashire C.C.—£4,929 for road reconstruction.

LOAN REFUSED.

Sheerness U.D.C.—£5,000 for the enlargement of the refuse destructor.

FORTHCOMING INQUIRIES.

SEPTEMBER.	£
14.—**Enfield.** For the provision of a disinfecting station (Mr. R. H. Bicknell) ...	760
14.—**Wembley.** For the extension of the sewage disposal works (Mr. A. W. Brightmore)	12,071
15.—**Carlisle.** For the provision of dwellings (Mr. Edward Leonard)	9,582
TOWN PLANNING.	
15.—**Leeds.** (Mr. George L. Pepler)	—

FOR OTHER ADVERTISEMENTS
See End of Paper.

THE SURVEYORS' INSTITUTION
(Incorporated by Royal Charter).
12 Great George-street, Westminster, S.W.

EXAMINATIONS, 1916.

Preliminary Examination.

Notice is given that the Preliminary Examination for the admission of Students will be held on the 12th and 13th of January next.

Candidates from the counties of Lancashire, Cheshire, Yorkshire, Durham, Cumberland, Westmorland, Northumberland, Staffordshire, and North Wales will be examined at Manchester. Candidates from other counties in England and Wales will be examined in London;

Irish Candidates will be examined in Dublin;

Scottish Candidates in Glasgow.

Professional Examinations.

Notice is also given that the Annual Professional Examinations for Land Agents, Valuers, Building, and Quantity Surveyors (held under the provisions of the Charter), will be held on the 27th to 31st of March next inclusive.

All English Candidates for the Professional Examinations are examined in *London*;

Irish Candidates in Dublin;

Scottish Candidates in Glasgow.

All applications for both the Preliminary and the Professional Examinations must be sent in before the end of September. The necessary Entry Forms for the various Examinations, and particulars as to subjects, course of examination, and prizes, can be obtained of the Secretary. (2,716)

URBAN DISTRICT COUNCIL OF WOODBRIDGE.

The above Council invite Tenders for the Supply of 200 Tons of Broken Granite, 1¾-in. gauge, to be delivered, carriage paid, to Woodbridge (G.E.R.) Station.

Tenders, accompanied by Samples, to be delivered (carriage paid) to Mr. Walter Brooke, Council Offices, Woodbridge, endorsed "Tenders for Granite," on or before the 23rd day of September, 1915.

The Council do not bind themselves to accept the lowest or any Tender.

W. GROUT WHISSTOCK,
Surveyor.

Woodbridge.
September 8, 1915. (2,718)

A STUDENT who has just taken his B.Sc. wants to work under a Borough Engineer for a short time. Please state terms per month and the works in progress. Near London preferred.—Apply Box 1,540, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (2,717)

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Bedlinog Borough, Wigan housing and town planning, Seaton Delaval refuse disposal, Denbigh refuse and cemetery, Dumbartonshire, Hursley sewerage and sewage disposal, Preston, Seaton Delaval water, gas and electricity, Barking. Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

ADMINISTRATION.

Tyrone C.C.—A letter has been received from the Local Government Board with reference to a recommendation by a committee that Mr. F. I. Lynam, county surveyor, be relieved of the control of roads and public works in the Strabane rural district, that he forfeit £75 of his salary, and that this amount be paid to Mr. Stuart, assistant surveyor, for the purpose of superintending the entire district. The new arrangement, said the Local Government Board, would, in fact, be one with three surveyors instead of two for the county, and one of these officers would have only one district without any assistance therein. The board could not consent to such an arrangement without a very full and convincing statement showing that there are imperative reasons warranting so grave a departure from the statutory provisions for the control of public works, which were satisfactorily in operation throughout the country. Such a statement would require to set out fully what steps had been taken to remedy any defects experienced in the existing arrangements, and to demonstrate clearly that these defects could not be rectified without recourse to the very drastic change proposed. It was decided to refer the communication to the Strabane No. 1 Rural District Council.

BUILDINGS.

Bideford T.C.—The Bideford members of the Joint Hospital Committee have sent the plans of the proposed isolation hospital alterations and additions to the Public Health Committee of Devon County Council, pointing out that when the Order was made the estimated expenditure was between £2,000 and £3,000, whereas the present plans showed an estimated expenditure of between £8,000 and £9,000, and asking the Public Health Committee if the plans could not be modified and the cost very much reduced.

Blackpool T.C.—It is estimated that the cost of converting the racecourse into a temporary hospital will be £25,000. This will be met by the War Office, the duty of the town council being limited to the preparation of plans, letting of contracts, and the supervision of the work.

Doncaster T.C.—It has been decided to erect a public convenience in North Bridge-road, at an estimated cost of £230.

Folkestone T.C.—It has been agreed to erect a public convenience on a site contiguous to the town hall at an estimated cost of £400.

Ludlow T.C.—The council have adopted a resolution, moved by the Ludlow Joint Hospital Committee, not to proceed further at present in the matter of providing a hospital at Castle Arms or elsewhere.

Ripon T.C.—The Local Government Board write that they are unable to grant the city council's application for powers to borrow £250 for the construction of six additional baths in Park-street.

Wigan T.C.—A committee has been appointed to go into the provision of better accommodation for the various municipal departments.

HOUSING AND TOWN PLANNING.

Cosford R.D.C.—The Local Government Board in a letter state that they would be unable to sanction loans for a scheme in the rural district in respect of housing at Elmsett during the present emergency, and that they did not think, in view of the heavy estimated deficit and the low rent obtainable, the council would be justified in erecting houses at the present time. They also suggested that plans of a cheaper type of house should be prepared, and that the parlour might be omitted. The council have resolved to postpone the matter for the present.

Seaton Delavel U.D.C.—The council have received authority to prepare a town planning scheme.

Swansea T.C.—At a meeting of the Housing Committee last week, the acting borough architect reported that, although some dilapidated dwellings had been put in order, there were still many whose owners had been ordered to repair them in which no start had been made. He asked whether in the present financial condition of the country it was the wish of the committee that the work should proceed. Mr. Molyneux, while admitting that in some cases insistence might prove a hardship, thought there was a tremendous amount of insanitary property in the town, and war or no war it ought to be put in order. It was decided to insist on the necessary repairs being carried out immediately.

Tredegar U.D.C.—The council decided on Tuesday to postpone the workmen's dwellings scheme for six months.

PARKS AND OPEN SPACES.

Salford T.C.—What was formerly known as the Sewerage Works, Langworthy-road, Pendleton, has been converted into a park, which was formally opened to the public last week. The park is 6 acres in extent, and it contains two bowling greens and six tennis courts.

Swansea T.C.—It was reported at a meeting of the Parks Committee on Tuesday that, owing to the financial restrictions, only £197 was being spent on the upkeep of open spaces worth £22,000, and not a halfpenny on the maintenance of the 9 miles of walks. In response to the appeal for economy the estimates were reduced by £2,080, and, owing to the war, the revenue ordinarily obtainable from games was greatly reduced. The chairman, Mr. Lee, thought it possible that necessary repairs might remain for a year, but if they neglected them longer the property would depreciate rapidly and in a couple of years they would have to spend an enormous amount.

REFUSE COLLECTION AND DISPOSAL.

Denbigh T.C.—The council have purchased a site for £680 for the purpose of a dust destructor, the property acquired including chimney stack, sheds, railway siding, and turntable.

ROADS AND MATERIALS.

Arbroath T.C.—The Streets Committee recommend the construction of a new street in continuation of Helen-street.

Bideford T.C.—Totnes Rural Council asked the council's support to a resolution in favour of petitioning the county council to allow the district councils to reduce the quantity of stone placed on the main roads wherever possible on account of the reduced traffic on the roads. Mr. H. N. G. Stucley: In the Bideford district there has been a tremendous amount of motor and tourist traffic. It was agreed not to support the proposition.

Glasgow T.C.—The city council have sanctioned a scheme for the improvement of the approach to the Kelvinside art galleries, at an estimated cost of £1,000.

Diss U.D.C.—The surveyor, Mr. A. Cooper, has submitted a plan for repairs to Walcot road, rendered necessary by the damage caused by military traffic, and the Highway Committee have been authorised to endeavour to arrange terms with the Road Board.

Dumbartonshire C.C.—The county road surveyor, Mr. James Andrew, submitted recently to the Western District Committee a proposal to spend £1,860 on bituminous binding, and it was stated that the work would be put in hand conditionally upon a grant of £600 being received from the Road Board.

Hursley R.D.C.—The surveyor, Mr. A. H. Brain, has reported to the council that the War Office have sanctioned the payment of £4,456 for repairs to several roads.

Romford R.D.C.—The tender of Messrs. Parlby & Beesley, at £82, has been accepted for the widening of Park-lane corner, north-west Hornchurch.

Strood R.D.C.—The surveyor, Mr. L. Randerson, submitted a further report in reply to statements made at the last meeting with reference to the result of the council having some years ago adopted direct control with regard to the making and repair of roads in three of the largest parishes, where previously the work had been done by contract. He pointed out

that any increase there may have been in later years was due to increased cost of material, labour, and haulage, but when these items were considered there had been a considerable saving. The council considered, and eventually adjourned, a proposition to acquire their own haulage plant, and also to take over and work a gravel pit at Shorne.

Winchester T.C.—The city surveyor, Mr. W. V. Anderson, has prepared, and the council have approved, a scheme for further widening Bridge-street, at an estimated cost of £1,187.

SEWERAGE AND SEWAGE DISPOSAL.

Gelligaer U.D.C. Mr. Raikes, of Messrs. Willcox & Raikes, on Tuesday submitted plans and specifications for the construction of a sewer in the Cylla and Deri Valleys to link up with the main trunk sewerage scheme for the Rhymney Valley now in progress. It was decided to write to the Local Government Board asking if they would sanction the cost of preparing the plans and specifications.

Prestatyn U.D.C.—The council have approved the plans of a sewerage scheme which is estimated to cost £20,000.

Seaton Delavel U.D.C.—It has been agreed to carry out an extension of the main sewer, at an estimated cost of £1,000.

Winchester T.C.—The city surveyor, Mr. W. V. Anderson, has received instructions to prepare a plan for a supplementary storm-water outfall in Victoria-road.

Worcester T.C.—The Sewerage Committee recommend the council to instruct the city engineer to lay the sewer for the drainage of the Malvern-road district, at an estimated cost, including wayleaves, of £550, but to delay the work until the making of the next rate, or until the termination of the war enables the council to apply for sanction to a loan for carrying out the work.

Wrotham U.D.C.—The Local Government Board have intimated that the proposed sewerage scheme is generally satisfactory, subject to certain points of detail which would be dealt with later, but that a loan would not be sanctioned for the work at present.

WATER, GAS, AND ELECTRICITY.

Armagh U.D.C.—Consideration is being given to the provision of a scheme for electric lighting.

Barking U.D.C.—The cost of the electrical plant which it is proposed to instal has been reduced from £18,000 to £13,536, with £1,600 for buildings.

Bristol T.C.—It has been decided to reduce by one-third the use of the electric and gas street lamps, one in every three not being lighted.

Clutton R.D.C.—The scheme for the supply of water to the village of Stanton Drew has been completed. The work was carried out under the direction of Mr. Brown, waterworks manager.

Garstang R.D.C.—A scheme is being considered for the extension of the water supply to Great Eccleston and Hambleton, at an estimated cost of £1,167.

Lleyn R.D.C.—It has been resolved to provide a water supply for Abersoch.

Macclesfield T.C.—The Gas Committee have agreed to a proposal for repairs to and renewals of the gas-works plant, at an estimated cost of £800.

Northampton T.C.—A recommendation will be submitted to the town council for water main extensions estimated to cost £2,000.

Oldham T.C.—The Electricity Committee have decided to instal a motor-driven compressor, to fence in with iron sheeting part of the land adjoining the cooling towers at Greenhill, and to remove the old 200-kw. direct-current turbo-generator.

Prestatyn U.D.C.—The Local Government Board are being asked to sanction a scheme for the filtration and softening of the water supply, at an estimated cost of £4,000.

Sandgate U.D.C.—The council have agreed to borrow £755 from the Public Works Loan Board, at 4½ per cent interest, for the purpose of the waterworks.

Watford U.D.C.—The council are endeavouring to obtain a further loan of £10,000 for water supply purposes.

MISCELLANEOUS.

Belfast T.C.—The council have adopted recommendations of the Tramways and Electricity Committee as to economies in administration of the tramway undertaking which are estimated to effect a saving of £4,300 in the ensuing six months.

Glasgow T.C.—The corporation recently appointed a special committee to consider how the production of food could be increased by utilising ground belonging to the city. The Parks Committee suggest that as an experiment a field extending to 9 acres at the south-east corner of Tollcross Park might be converted into allotments for the cultivation of vegetables for food. A sub-committee has been appointed to confer with the special committee.

Swansea T.C.—The borough surveyor, Mr. J. R. Heath, reported to the Highways Committee that he had received from the borough treasurer a letter asking what amendments he could suggest in the annual estimate with a view to curtailing expenditure. The borough surveyor reminded the committee that the Local Government Board did not in their letter suggest that any reduction could be made in the maintenance of roads, and this was a matter in which he could not recommend any reduction, as the work was absolutely necessary. He thought a real reduction could be made in public lighting. Owing to the Defence of the Realm Act they had already effected a reduction, but on the other hand there was an increase in the cost of gas. To the Parliamentary and General Purposes Committee the borough surveyor replied that the reductions in the staff which he suggested could only be made on the understanding that certain works would be shut down. He also wished it to be understood that in normal times his department was not over-staffed, but rather under-staffed.

PERSONAL.

Mr. R. Stephens, surveyor to the Chard Rural District Council, has been appointed a Lieutenant in the Army.

Mr. J. Stanley Roper, surveyor of highways to the Hollingbourne Rural District Council for thirty years, has resigned.

Mr. G. Winship, borough surveyor of Abingdon, has been voted £25 for work in connection with the waterworks extension scheme at Wootton.

Mr. W. J. Edwards, Carnarvon, has been appointed surveyor and sanitary inspector to the Abergele Urban District Council, at a salary of £100 a year.

Mr. W. J. Ball, assistant borough surveyor of Crewe, who is about to join the military forces, has been granted £112 10s. (half-pay) during his absence on service.

Mr. E. E. Finch has just been appointed surveyor under the London County Council at a salary of £800 a year. Six years ago he was appointed assistant surveyor to the council from Bethnal Green.

Mr. A. E. Brookes, county surveyor of Durham, has been sent for by the Government to act as engineer-in-chief in the construction of the whole of the new military roads on Salisbury Plain by direct labour.

Mr. Clifton Lund, under the provisions of the Spen Valley Amalgamation Order, has retired from the position of surveyor and water engineer of Cleckheaton. Nominally, he ceased to hold office some little time ago, upon the appointment of Mr. A. Rothera, of Liversedge, as surveyor to the new Spenborough Council; but in point of fact he has continued until now to act as surveyor for the Cleckheaton portion of the new area, and will probably remain at the town hall for some little time yet in an unofficial capacity. In the near future, however, he intends to remove to Southport, where other members of his family are settled. Recently Mr. Lund was presented by his old colleagues with a smoker's cabinet in oak.

Sir William Hearlein Lindley, upon whom the University of Darmstadt has conferred the degree of doctor, is well known in municipal engineering circles. Although Sir William is English, and was educated at London University, he was born at Hamburg, and the bulk of his engineering enterprises have been carried out in Germany and Austria. He made a speciality of sewer construction, and his services were requisitioned by a number of German municipalities. Frankfort-on-Maine gave him the sole direction of its water supply, and appointed him its chief engineer. In that capacity he designed the city's harbour and canalised the river Maine, with the result that Frankfort's trade was enormously developed. His knighthood was conferred in 1911 as a reward for services rendered to the British Royal Commission on Canals and Waterways.

The Protection of Ancient Buildings.*

BY W. A. FORSYTH, F.R.I.B.A.

The careful use of an old building ensures its best protection. Municipal and county authorities are frequently the guardians of buildings of historic interest and architectural beauty. The repairs are placed invariably in the hands of the officer engineer or surveyor, whose skill in the solution and execution of scientific problems is supposed to fit him for the subtle work of repairing ancient structures. The actual reparations are made by the works department, whose experience in highly technical affairs is unquestionable, but whose knowledge of materials and their application for such a purpose is limited and cannot be expected to be otherwise.

Such were the circumstances of a recent case in which one of the borough councils in London dealt with the preservation of an historic building in an advanced state of decay. The completed work aroused criticism, and in the course of discussion the borough surveyor admitted that the views expressed by an architect, a specialist in this type of work, would have had more satisfactory results and the particular character—historical and æsthetic—of the fabric more carefully preserved, had such process of repair been generally known. Arising from the incident, a suggestion was made that some general notes upon the subject should be laid before the institution, embodying the views held by the Society for the Protection of Ancient Buildings.

Recent legislation has enhanced the importance of ancient works. The Ancient Monuments Amendment Act imposes penalties for defacing scheduled structures. The Town Planning Act requires that all municipal lays-out shall be adapted to the retention of an ancient work.

It is not possible to bring the whole or any large part of the subject into review within the limits of this paper. A few general practices can, therefore, only be attempted, and it is hoped that something that is new may reach many whose activities extend to reparations, and who will be induced to apply these recommendations to such structures as town halls, castles, bridges, town walls, gateways, memorials, &c. Old buildings are decreasing in number year by year, so that it is the more important that not only shall they be preserved, but that they shall be cared for and repaired in such a way that their traditional character shall be maintained. The fate of these public possessions frequently rests upon the report of the borough engineer or surveyor. Their value is not always appreciated, and they are dealt with very often by the ordinary process of specification and contract. There are few such works, however, that do not require special knowledge, and it is in the majority of cases essential that a second opinion be obtained, in order that the general treatment be the best for the particular circumstances, for it must be remembered that all examples are different.

All repairs or replacements should be distinctive, yet harmonious, for they form part of the story in stones. If the truth of the story is veiled by attempts at imitative reproduction, the values of the building are lost.

The repair of buildings is one of the processes which is best carried out by a municipal works department under experienced supervision. The operations are not fettered by contract sums, time clauses, or the intervention of famous arbitrators; yet, where such a department does not exist, it is desirable to institute some special form of agreement in order to set reasonable limitations upon the operations, without affecting the flexibility of the proceedings. Repairs, however, must not be unduly hastened, and should be supervised by an expert. It is not possible to specify all the items in a general work of repair, and all attempts at estimating the cost are purely speculative.

It is important that such structural works as underpinning be not too hurriedly decided upon and carried out. Ample test and observation must be made, for it is known that many a building was safer before than after that operation.

Materials used in repairs should, as far as possible, be new, and local traditional custom should influence their choice and method of building. The use of old materials from other buildings is misleading, and tends to create an undesirable market in such commodities. All old materials, however, such as glass, metal, &c., must be carefully collected and stored.

The tendency to over-repair should carefully be avoided, anticipated defect must not be considered, as a great deal deal of wanton injury will thereby be perpetrated.

Above all it must be remembered that repairs cannot be hastened; slow-setting materials are invariably those of greater lasting quality.

Any additions that may become necessary should be designed in a different manner from the old buildings to which they are to be attached. They need not be unsightly, although possessing a modern character so that no mystery need be cast upon the structural story of the fabric.

The introduction of heating, lighting and sanitary works in an ancient structure, while ensuring its use, are actually enhancing the means of protection.

Heating chambers and flues should if possible be in detached positions; pipes and other parts must be put in such places as cause the least disturbance, yet not necessarily in the most efficient situations.

All waste and ventilating pipes should upon these occasions be permitted in the interiors of houses under certain conditions. The sanitary authority must have regard to the educational value in the undisturbed character of ancient façades and roofs.

Preliminary investigation cannot be too thoroughly undertaken. Photographs completely showing the outward condition of the fabric, supplemented by plans, elevations and sections, carefully drawn in freehand, together with descriptive notes of the materials, fractures, inclinations, levels, drains, watercourses, nature of soil, &c., should form part of an exhaustive report and recommendation.

"Tell-tales" should be applied to fractures in masonry or brickwork, in order to ascertain if the indicated movements are active or quiescent. These narrow strips of cement or plaster should be very carefully made—that is to say, the fissure should be filled in flush with the wall—the walls well saturated, and the cement strip covered up and allowed to set slowly. The "tell-tales" should be dated and examined frequently.

SCAFFOLDING.

Scaffolding frequently injures the face of a building, both in course of erection and in the means of fixing. It is, however, a golden rule that all scaffolds should be independent of the old structure around which it is applied; they should be of such a character as to afford the architect easy access to all parts. It is not necessary, therefore, to disturb old facing with new putlog holes. All work liable to injury must be covered up. It should always be remembered that the position and intervals of the staging should be adapted to the levels required. The ends of all poles facing a building should be covered with strawbags as a measure of protection.

SHORING.

Shoring should be left in position as long as possible. Where the repair of an important work is likely to be prolonged it is necessary to build concrete sills or abutments in the ground, so that the timbers may not be affected by the moisture in the soil. Timbers should be lime-washed, in order that they may readily be seen and that they may be preserved.

All cutting out to receive needles should be made good in different materials from the old work, in order to record the disturbance. Shoring must be complete before repairs are commenced.

SUPERVISION.

It is the custom of the society to recommend that any expert employed should be continually upon the works, and, for such times as he may be absent, that an efficient representative be installed. Supervision is vital in works of this nature. Difficulties are perpetually cropping up, and fresh discoveries arise which require immediate direction from the supervisor. Such constant attendance will also prevent destruction of ancient work, and will tend to check all wastage in labour and material.

GROUTING.

Repairs are chiefly required for old walls, more

* From a paper presented at the recent annual meeting of the Institution of Municipal and County Engineers.

than any other features. These have invariably become defective from their faulty bonding, from roof thrusts or weak foundations. The solidifying of the walls is usually necessary before such operations as underpinning, the insertion of dampcourses, the provision of tie-rods, &c., can be commenced.

No greater advance has been made in the repairing processes in recent years than in that of grouting. Many a condemned building has been saved, and many a weak structure made sound by this means, and more particularly when used under pressure.

The injurious effects of vibrations upon ancient buildings, especially those having rubble-built walls, due to fast and heavy modern traffic, is a matter of grave importance.

It frequently happens that a fractured rubble wall, a weak footing, an insecure bridge has failed, and can only be repaired by first consolidating the masonry before foundations or other repairs are dealt with. Briefly stated, the method of applying cement grout under pressure is as follows: The operation, like underpinning, must be performed in small sections. All loose dry mortar and dust is first removed; that which escapes being raked from the open joints is blown out. Great care must be taken not to dislodge the aggregate of the wall—that is to say, the rubble, the bricks or stones—as the case may be. Large facing stones should be wedged up.

The parts of the wall thus cleared should then be well saturated, also under pressure, after the face joints are blocked up, usually by wet clay. This moistening will slake the inert properties of ancient lime, and assist the process of solidification. The grout, mixed according to requirements, is then forced by the machine into the wall through a small aperture left for the purpose. The clay joints should be watched, in case the grout escapes prematurely; experience will determine when the particular section is fully grouted.

It is usual to use slurry of 1 part of cement to 1 part of sharp, but not too coarse, sand. Frequently neat cement is injected into the fissures. The effect of these injections is to solidify the wall, leaving it in a state reasonably safe for the underpinning, the cutting out of cracks and bonding in strong material, or other operation.

The clay sealing of the joints is removed after ordinary setting has begun to take place, when it will usually be found that the grout has fully penetrated the wall or structure under treatment. It is then desirable to point the more open joints of the external face to exclude weather. It is not necessary, however, to point internal joints, but to leave them open in order to show that the old materials have been grouted.

Grouting by hand has its limitations, and is dependent upon gravitation. Under mechanical pressure the liquid rises to considerable heights and travels surprising distances.

There are occasions—usually in thick walls—when hydraulic blue lias lime-mortar would be adequate as a grouting medium. Expansions and, in many stones, an unpleasant discoloration are then avoided.

Lime grout is very desirable where walls have not fractured but have hollow places. Lime-mortar built walls have endured a sufficient time for all ordinary purposes. There are many limes which harden to a very great degree. Smeaton used Leicestershire limes in the erection of lighthouses. One of the Derbyshire limeworks has been working continuously for 700 years.

A great advantage of this method of repair is that the two faces of a wall are maintained during repairs.

Winchester Cathedral has been saved by grouting. Sir Francis Fox has also grouted and saved historic bridges condemned by county authorities; he has so treated the walls of a large institution when the entire rebuilding was threatening the trustees whose finances could not bear the strain; he has grouted the walls of an early eighteenth century London building upon which a dangerous structure notice had been served by a watchful district surveyor, who, after testing the repaired house, accepted the process for the more customary one of demolition.

Many a condemned external or party wall is pulled down when grouting and bonding-in of new work would have rendered the structure safe.

RUINS.

Public authorities owning ruined or vacant structures are constantly concerned with their repair. In addition to pointing joints in masonry or brickwork, the tops of walls require special care in order to preserve the building and to retain the ruined character. It is important that too much repair be not attempted, or that any work be done in anticipation of defects. Official reparation on these lines has been known to produce the effect of "new" ruins.

The tops of walls, after the necessary preparation, can be covered with asphalt, tar-paving, tile or stone paving, &c., and then covered with turf laid in several cut thicknesses, and grass allowed to grow upon the top as a protection to the paving. By this means the ruined state is retained without detriment to the construction, and the old skyline left undisturbed.

The modern granite fence walls in Cornwall are coped with turf, and the stones are bedded in turf and jointed in soil. These walls are extremely durable and picturesque. Sometimes a thin projecting slab is introduced below the turf top to throw off water. Similar treatment is applicable to old walls where the materials are loose, and especially to old exposed foundations marking the lines of a destroyed castle. Too much encouragement, however, must not be given to vegetation, especially ivy. All such growths should be kept under control, and subordinated to the architectural interest.

MASONRY.

The superficial decay of stonework is largely due to atmospheric causes, which are usually more aggressive in the neighbourhood of large towns.

No moulded or carved feature should be on any account reproduced either in stone or any other material. The Society for the Protection of Ancient Buildings has always recommended that badly decayed ashlaring be rebuilt in roofing tiles laid horizontally and rendered in mortar.

The same methods are applicable to brick walls, and it has the great advantage of ensuring the pinning up of the new material where such is not always possible with the insertion of large stones or bricks.

Moulded mullions, string-courses, drip-stones, or other features can easily be repaired by tiles laid in lime-mortar and roughly shaped to follow the feature under repair. Tile-built repairs involve a minimum of disturbance to old, sound work in the preparation of a decayed wall.

A general method which the society recommends for the repair of decayed stone facing ensures a definite bonding of new to old work. The original walling must be well saturated and cleaned, and the new insertions must be allowed to take a natural course in setting, receiving sufficient protection from heat, frosts and winds. The mortar should preferably be composed of 1 part of blue lias lime and 4 parts of coarse, clean, sharp sand in most cases.

Aesthetic circumstances will determine how far the tilework shall be hidden by the mortar, but a proportion of exposed red material will invariably add to the pleasing effect of the building and indicate the repairs.

When a weak wall cannot be grouted, and it is only possible to repair by bonding-in new material, it is important that the more interesting face be retained at the expense of the less valuable.

Rubble facing which has become loose should be repaired by re-using the old stones or flints, cleaning and mixing them with lias lime-mortar stiffened by a small proportion of cement, and the whole laid in and punned up to a shutter board after the manner of concrete building.

In less decayed rubble facing the loose members may be reset and pinned in with a roofing tile. This was a mediæval practice.

In the repair of masonry and brickwork reinforced concrete can be structurally used with advantage in footings, floors and lintels. The proportion of steel to concrete must not be unduly large, but sufficient for taking up tensile strains. The metal must be well covered by the concrete for preservative reasons.

Wrought iron let into exposed stonework should be seldom used owing to the tendency of rust to split the masonry. Iron guard bars or saddle bars can have gun-metal or bronze sockets let into the walling.

Machine-made pressed bricks should not be employed when they have to be plastered; ordinary hand-made stocks or wirecuts are best for this purpose.

For excluding dampness from a building it is most desirable that stone copings of gables and parapets be taken off and reset upon a slate or other efficient dampcourse. Stone window-sills should receive similar treatment when opportunity permits.

A common practice in repairing stone facing in a partial state of decay is the application of preservative solutions. These are mainly patent processes the uses of which require careful preliminary investiga-

tion, especially in testing samples of stone. It is important that the expanding action of frost be resisted, so that in the main all these methods should only be applied in reliable weather, and when the work to be treated is quite dry.

One of the simplest and in many ways the best process is that of limewashing.

POINTING.

It is of the greatest importance first to determine what shall be pointed and what shall be untouched; but the decision may be governed by the extent to which open joints are liable to cause injury to walls and to admit water to the interior. A slightly recessed joint need not be touched; a deeply sunk joint must be pointed.

Great care is required in preparing open joints for new mortar. As a rule any joint which cannot be prepared by raking should never be pointed. No joint should ever be cut or hacked out unless for some special purpose, such as grouting. It is, of course, of paramount importance that the wall be well saturated before inserting the new mortar; this moisture will energise the inert properties of old lime in the wall, and tend to promote a structural combination in the two mortars.

An ancient building should never be pointed in strong cement. Lias limes and sand are quite sufficient, and more satisfactory in appearance.

The mortar joints should never be cut with a trowel; the material should be pressed in by the fingers or by a wood tool. A slightly recessed joint has advantages in weathering and appearance over a flush joint. In every case, however, some slight variation from the original mortar joint should be made, and all pointing should follow the accidental lines of bricks and stones.

Scottish Sanitary Congress.—The annual congress of the Incorporated Sanitary Association of Scotland was opened in the Masonic Hall, West Regent-street, Glasgow, on the 1st inst., the formal business proceedings being followed by an illustrated lecture by Dr. R. M. Buchanan, bacteriologist to Glasgow Corporation. In his presidential address yesterday, Mr. Robert Lambie, chairman of the Public Health Committee of Lanark County Council, took for his subject "Twenty-five Years of Local Government."

Manchester Sanitary Department.—The report of the Manchester Sanitary Committee for the year ended March 31st last shows that the number of insanitary dwellings certified to the committee during the year was 696. Of these 667 were ordered to be closed, and in twenty-nine the cases were adjourned. In 664 of these cases the orders have been allowed to remain in abeyance, as the owners in the majority of cases have agreed to make the necessary alterations to satisfy the requirements of the committee. The house drainage department during the year have, after notice, or at the request of the owners, redrained 983 dwelling-houses and 611 business premises, at a cost of £13,055, of which amount £10,360 was charged to the owners, and the remainder (£2,695) to the City Fund. Since the formation of the department in April, 1896, the total value of the work done is £519,430, £405,445 of which was charged to the owners and £113,985 to the City Fund.

Earby River Pollution Case Fails.—The Earby Urban District Council were summoned recently at the Skipton Petty Sessions at the instance of the Yorkshire Fishery Board for polluting Broughton Beck, a tributary to a salmon stream. It was stated, on behalf of the prosecution, that the water in the beck was found to be very dirty, and that a number of dead fish were seen. For the defence it was stated by Mr. J. E. Aldersby, surveyor to the Earby Urban District Council, that since 1894 £11,000 had been spent by the authority on the improvement of their sewage works, which served a population of 6,000. The assistant surveyor, Mr. Faulds, agreed that the effluent was bad when he saw it in company with the water bailiff. The dead fish pointed out by the bailiff were 3 yds. or 4 yd. higher up than the outfall, and above the effluent from the sewage works, while the condition of the stream higher up still was very dirty with oil and grease. Mr. J. C. Waddington, clerk to the council, contended that the Earby Council had not knowingly and deliberately allowed crude sewage to enter the stream. The bench held that the prosecution had failed. Asked to state a case, Mr. J. W. Morkill said it was no necessity to do so, the issue having been decided upon fact and not on law.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Why did the East Preston Rural District Council wish to suspend inspections of insanitary houses under the Town Planning Act during the war, and why should the Local Government Board have declined to allow this suspension, except where it concerned cases of actual nuisance, and that only such action should be taken as was immediately necessary? Does it not go without saying that a local authority would not unnecessarily take action in such cases, or, at all events, is it not devoutly to be hoped that they do not worry their citizens without just cause?

* * * *

Is it not rather an expensive method of painting street signs to employ for the work two men at 1s. 3d. per hour, especially when one of them has no heavier task than that of standing at the foot of the ladder? Was it at all surprising that when the attention of the surveyor of a certain urban district was called to this fact he should have stated that "he would see what could be done to have the work done cheaper"? Is this sort of over-payment for not very skilled work going to make it any easier for people of modest means to live in this country?

* * * *

Is it not evident, from the remarks contained in the issue of THE SURVEYOR of August 27th, with regard to the splendid work done by the Italian engineers during this terrible war, that the mantle of their predecessors, the Romans, has fallen upon their shoulders? Was it not the splendid engineering triumphs of that great race which were eulogised by a classical historian in lines which were "freely" translated into English as follows:

> If all the world was flat and smooth,
> There'd be no masterful creation,
> The chasm to the engineer
> Means bridges, roads, and reputation.

* * * *

Was there not a good deal of truth in Mr. Croome's statement at the recent sub-district meeting of the Institution of Municipal and County Engineers at Cromer that surveyors in the country were not anxious to spend time and money in attending London meetings where Metropolitan surveyors discussed problems of road construction at 15s. per square yard when most of the country surveyors "thought themselves fortunate if they were allowed 15d. to do it"? Are there not very good grounds for endeavouring to get district centres in which to hold such meetings as would be useful to the local surveyors, and is it not to be hoped that Mr. Croome will be success-ful in his crusade?

* * * *

How many years does it take the public to forget the names of some of our greatest engineers? Why is it that the name of Bazalgette, almost the first and foremost of municipal engineers who made London habitable, and constructed the beautiful Thames embankments, should be by now almost forgotten; and that a guide to London attributes the construction of the embankments to Brunel?

* * * *

Is it not rather remarkable that, according to a recent issue of the *Belfast Newsletter*, it is stated that the corporation of that city have erected 252 houses for the working classes, and that in extolling these houses (which, by the way, only have a kitchen and two bedrooms) the journal named says that "the new streets are wide and paved with pebbles"? Shades of our grandfathers! Did we not think that these so-called "kidneys" were as dead as Queen Anne so far as paving was concerned? What are the Sanitary Authority of Belfast about if this statement is correct?

* * * *

When will surveyors of rural districts, and some of the smaller urban districts, be able to strike for better wages? Does it not seem as if there was "something wrong somewhere" when we know that £3 a week is looked upon as quite a good salary for a surveyor (who is generally the sanitary inspector as well), while mechanics and colliers, who are earning quite as much, or even more, are always "on the strike" for increased pay?

* * * *

Is there not a very good instance given of the phenomenal growth of motor-omnibus traffic on our

roads when we read, in a recent report by Mr. Dryland, the county surveyor of Surrey, that on a certain section of the London and Portsmouth road, near Malden and Coombe, there was no motor-'bus traffic in the year 1912, whereas in the year 1913, according to a comparative table of traffic for a period of seven days, this traffic had attained the large figure of 1,235 motor omnibuses? Is it not evident that this description of vehicle is likely to extend its ramifications in all directions, regardless of the effect it may have on the surface of our roads?

* * * *

In the same report is there not a slight touch of sarcasm in the paragraph which states: "The wood-paved portions of the roads in the borough (Richmond) have continued in excellent condition. The water-bound macadam between Hill-street and Petersham has been more or less rough all the year"? Could not those who know this latter stretch of road have said a good deal more about this old-fashioned construction and its present condition? Is there not a rather delightful "touch" in comparing wood pavement with water-bound macadam?

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

INSTITUTION OF MUNICIPAL ENGINEERS

President—Mr. W. H. Matthews Jones, City Engineer and Surveyor, Chester.

NORTH-WESTERN DISTRICT.

A visit will be paid to Oldham Corporation Waterworks, Delph, to-morrow (Saturday).

2 p.m.—Leave Manchester Exchange Station. Return fare 2s.

3 p.m.—Arrive at Delph.

3.20 p.m.—Arrive at Delph waterworks.

5 p.m. Tea at Spring-house Farm, 2s. each.

7.48 p.m.—Leave Delph.

8.45 p.m.—Arrive in Manchester.

Meet under the clock outside Exchange Station, Manchester, not later than 1.45 p.m.

R. J. McKenn,
Hon. District Secretary.

29 West Church-street, Heywood.

B. Wyand,
Secretary.
39 Victoria-street,

TOWN-PLANNING INSTITUTE.

ARRANGEMENTS FOR 1915-16 SESSION.

A meeting of the Town Planning Institute will be held on September 24th at 92 Victoria-street, Westminster, S.W. (by kind invitation of the Institution of Municipal and County Engineers), at 8 p.m., and it is hoped that this the initial meeting of the Winter Session will be well attended.

The arrangements for the session are as under:—

September 24th.—Opening address. By Raymond Unwin, F.R.I.B.A. (M.), president. "Town Planning Literature." By Patrick Abercrombie, M.A., A.R.I.B.A. (M.).

October 15th.—"The Placing, Design, and Arrangement of Railway Terminals." By James Crossland, L.R.I.B.A.

November 5th.—"Limited Owners and Town Planning." By J. S. Birkett, M.A. (L.M.).

December 10th.—"Arterial Roads in Greater London." By W. R. Davidge, F.S.I., Assoc.M.Inst.C.E. (M.).

January 14th. "Open Spaces and Town Planning Schemes." By Lawrence W. Chubb (A.).

February 4th.—"The Town Planning Proposals of the Urban Land Report." By Seebohm Rowntree (Hon.M.).

March 10th. "Width and Allocation of Space in Roads." By F. Longstreth Thompson, B.Sc.

April 14th.—"Horizontality and Verticality in the Architectural Treatment of Town Planning Schemes." By Barry Parker, F.R.I.B.A. (M.).

ROYAL SANITARY INSTITUTE.

STUDENTS' LECTURES.

The fifty-ninth course of lectures and demonstrations for sanitary officers will commence on Monday, September 20th.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

CLERK OF WORKS.—September 13th.—Wharfedale Rural District Council.—Mr. Edgar C. Newstead, clerk, Council Offices, Borogate, Otley.

SURVEYOR.—September 15th.—St. Columb Major Rural District Council. £100 a year.—Mr. W. H. G. Hancock, acting clerk.

MUNICIPAL COMPETITIONS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

YORK. — November 30th.—Schemes under the Housing and Town Planning Act, 1909, in connection with certain areas within and without the city of York, for the corporation. Premiums, £100, £50 and £25.—Mr. F. W. Spurr, city engineer, Guildhall, York.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

AYLESBURY.—September 11th.—For the erection of a caretaker's house at the isolation hospital, for the urban district council.—Mr. W. H. Taylor, engineer and surveyor.

GLAMORGAN.—September 11th.—For plumbing and painting at police courts and police station, for the Joint Standing Committee.—County Hall, Cardiff.

LAMBETH.—September 16th.—For repairs and redecoration of house and offices at Providence Wharf, and the demolition of old depot premises at Stockwell, for the borough council.—Borough Engineer, Town Hall, Brixton-hill, S.W.

BIRMINGHAM.—September 16th.—For the enlargement of a telephone exchange, for the Commissioners of H.M. Works and Public Buildings.—Assistant Architect, H.M. Office of Works, 42 Paradise-street, Birmingham.

NEATH.—October 1st.—For the erection of an isolation hospital, for the Joint Hospital Committee.—Mr. J. C. Rees, architect, Parade Chambers, Neath.

Engineering: Iron and Steel.

LANARK.—September 13th.—For the installation of boilers and heating and hot-water supply, for the Middle Ward.—Mr. W. Arnot, 163 Hope-street, Glasgow.

TEDDINGTON.—September 13th.—For the installation of a hot-water heating apparatus, for the urban district council.—The Surveyor.

DUBLIN.—September 14th.—For the supply of labour, materials and plant for works at pumping station, for the corporation.—City Engineer, Castle-street, Dublin.

BLACKROCK.—September 14th.—For the supply of a steam type disinfecting apparatus, for the urban district council.—Mr. J. Mooney, clerk.

BALLINASLOE.—September 14th.—For the supply and erection of gas plant capable of supplying gas for 40-h.p. engine, for the urban district council.—Mr. J. L. Dunne, surveyor.

The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

Sewage Disposal: The Final Report.

The discussion upon the Final Report of the Royal Commission on Sewage Disposal, which took place at the recent meeting of the Royal Sanitary Institute at Brighton, and was printed in full in these pages last week, was opened in a very able manner by Dr. S. Rideal and Mr. J. D. Watson from their respective points of view as chemist and engineer, and both emphasised the difficulties which are likely to arise in the event of standards being fixed by the Legislature for sewage effluents. Dr. Rideal fears that if the recommendations of the Royal Commission are carried out it will result in the lowering of the quality of some of our rivers to the average or inferior article, and very seldom have the opposite effect. Further, he points out that, in order that a local authority may avail itself of the proposed relaxations from the general standard, it is necessary that the volume of the effluent and the volume of the recipient waters must be accurately known, but that neither of these factors is ascertainable with any degree of certainty. This is quite true, as there is scarcely a river of which a regular series of records over a considerable period have been taken. This is no doubt due to the fact that there is no authority whose duty it is to undertake such work, and it points to the need which has been urged in various quarters for a proper hydrographic survey of all the rivers in the country. This is a work which might well be undertaken by the proposed rivers boards under the direction of the central authority recommended by the Royal Commission. The uncertainty of the other factor is also well known by engineers engaged in designing new schemes of sewage disposal, and it is satisfactory to note that Dr. Rideal makes a suggestion which we have on several occasions brought forward in these columns to the effect that it would be preferable to base such calculations upon the populations contributing to the discharge of sewage effluent into the river rather than upon the uncertain estimates of the daily dry-weather flow usually made in connection with new schemes which are submitted to the Local Government Board for their approval.

Even in existing works it is only in a few cases that accurate records of the daily flow of sewage are available. In some cases a gauging weir has been fixed, but when the actual gauging has to be done by hand it is so seldom carried out over any considerable length of time that the few records which are taken are apt to be very misleading. The proper thing to do is to have an efficient self-recording appliance in regular use all the time. These are, of course, somewhat expensive, but if local authorities were only aware of the great value of such records in connection with the work of sewage disposal they would not grudge the expense. Mr. Watson, in dealing with this question of standards, pointed out that the recommendation proposes to do what experts of experience regard with the gravest concern. He stated that it is not that a standard for effluents is unnecessary, or that the standard of purification proposed is too high, but that it is the proposal to make it *statutory* that is the obnoxious feature. Being a practical man, he goes a step further, and makes a suggestion by means of which he thinks it would be found practicable to realise the ideals of the commission without raising the susceptibilities of local authorities. These proposals deserve the most careful consideration on the part of those who will be concerned in drafting the proposed Bill in due course.

In spite of these and other criticisms of the Final Report, Mr. Watson still has a good word to say for the work done by the Royal Commission. He shows that, taking the results as a whole, the sanitary engineer has been freed from the cast-iron rules under which he laboured in the past. He is not now compelled to provide land for treatment by irrigation; indeed, it has frequently happened that where it has been proposed to provide land of an unsuitable character for this purpose the Local Government Board have refused to sanction the scheme unless provision was made for complete purification by means of artificial filters. Dr. Rideal also pointed out that, in proposing a general standard with the possibility of relaxation when the volume of river water is considered in relation to the volume of the effluent, a great advance has been made, as it devises a system whereby a local authority is not required to incur any further expenditure on sewage disposal beyond what is necessary to

prevent the occurrence of actual nuisance. It will thus be seen that in spite of some defects there is much for which sanitary engineers and local authorities may be thankful, and if only the criticisms with regard to the question of statutory standards can be met, and, what is probably even more important, steps are taken to set up a permanent research department in connection with the proposed central authority and rivers boards, so that all new methods of treatment may be taken up and investigated on thoroughly scientific and practical lines, there is some hope that this country may continue to maintain its past position as foremost in the world in matters pertaining to sanitation.

* * *

London Water: Dr. Houston and Lime Treatment.

Despite the research work of Dr. Houston, the latest annual report of the Metropolitan Water Board contains no evidence that anything is yet being done towards the treatment of that part of the London supply concerning which Dr. Houston has spoken very clearly in the past as being in need of purification antecedent to storage. He has drawn attention in former reports to the water which, being of bad quality, is admitted to the reservoirs in time of flood, and it is apparently with regard to this water that the research work is necessary. As time goes on, and as the new storage reservoirs of the board are put into operation, the period of storage is increased, and we approach a condition of greater safety; but it seems that Dr. Houston is still of opinion that part at least of our supply ought to be treated, and a considerable amount of research work has resulted. Recently the advantages of lime treatment have been considered, and much experimental work has followed, which has been compared with similar results obtained elsewhere. Finally, in the recently published Eleventh Report, Dr. Houston describes in detail experiments carried out at Sunbury. In these experiments raw Thames water was treated with an excess of lime, passed through storage and sedimentation tanks, and then mixed with about four times its volume of Staines stored water in order to neutralise and precipitate the excess lime. This water was then filtered. The quantity of lime added to the raw water was ·986 lb. to 500 gallons of water, or approximately 1 part of lime to 3,160 parts of water. The chemical results of the treatment were satisfactory, but the point of chief importance is that the B. coli were devitalised absolutely in the liming tanks. From this result Dr. Houston argues that "river water, *no matter how impure*, may be brought into a condition of *absolute safety bacteriologically*, and *of great chemical purity chemically*, by means of lime."

This result is in agreement with the work done at Aberdeen, where the town supply was sterilised by lime treatment, and with the work done at Columbus, Ohio, by Messrs. Hoover & Scott. Both of these works have been dealt with formerly in these pages. It is not easy to grasp the special advantages of lime sterilisation over other methods. Even the layman can hardly be surprised to learn that 1 lb. of lime will kill the micro-organisms in 500 gallons of water. Apparently the quantity of lime used would be very great, and the quantity of lime sludge would also be great. Again, the neutralisation of the lime by means of pure water of four times the volume of the treated water seems to presuppose a supply where one-fifth or less of the water is in need of sterilisation, or where four-fifths of the supply is of good quality, for it must not be supposed that the sterile water mixed with the other four volumes will sterilise it. For, while it is clear that the water was sterile after it had been overdosed with lime, it appears to have contained coli in the majority of instances after it had been mixed with the Staines stored water, which were generally removed by the final filtration. It is not clear whether the lime treatment is likely to affect the filter adversely, but indications are to the effect that it will not. Though this method may be useful for the London supply, its application appears to be limited, and it is not very easy to understand why so much importance is attached to a method which appears to have been known to chemists for some time.

* * *

A Retaining Wall Inquiry.

Recently, Mr. R. C. Maxwell was engaged on behalf of the Local Government Board in an inquiry into a matter that has rarely if ever been the subject of official investigation. It concerned the defective state of a retaining wall on the main road at Cottingley, and the Bingley Urban District Council raised the question of the liability for its repair. The wall is down at several places, and it was contended that there is a danger to the public, as the ground falls from the footpath into the field adjoining. The owner of the land contended that he was not responsible for the repair of the wall, and a similar attitude was taken up by the West Riding County Council, who have control of the highway. The urban district council in the circumstances ask for an Order authorising them to proceed under sec. 31 of the Public Health Amendment Act, 1907, against the owner or occupier of the farm to compel repair of the wall. Under such an Order the owner or occupier would be served with the usual statutory notice, and in default of compliance the council would have power to do the work and recover the cost from him.

The owner of the property, in denying liability, submitted through his legal representative that the wall was not in his individual ownership. The onus of proving the ownership rested with the urban council, and the latter had failed to do this. It was further argued, however, that the liability rested with the county council as highway authority, the whole of the wall, both below and above the surface of the highway, being essential for the upkeep of the highway. For the county council it was argued that the liability was not legally theirs, as they were responsible for the maintenance of the highway only so far as is necessary for the traffic and passengers upon it. The retaining wall, up to the level of the road, was necessary, and this they maintained, but they did not maintain or repair any fence wall above the level of the road. There are, of course, plenty of instances of this kind. As it was regarded as a test case, a suggestion made by the inspector that the parties should confer together with a view to reaching an agreement was rejected by the owner of the land. It is almost certain that, whatever decision may be given by the Local Government Board, the matter will eventually go to the High Court for judgment. Considering the number of cases in which the issue could be raised, it is highly important that the question of principle should be finally settled, and liability placed upon the right shoulders.

* * *

Village Sanitation.

The action of the Hampton-in-Arden parish meeting in declining to undertake a scheme for the removal and disposal of the refuse of the village until after the war affords an example in a small way of an economy which, even in present conditions, ought not to have been exercised. The facts of the case may be gathered from a report of Mr. T. H. Negus, the surveyor to the

Meriden Rural District Council, to which reference was made in a recent issue of THE SURVEYOR. The population of the village is about 1,000, the number of inhabited houses being 270. No system of scavenging is in operation, and the result is that a number of nuisances are permitted to continue, although they must form a serious menace to the health of the village. According to Mr. Negus, the refuse is stored in all sorts of places, sometimes within a few feet of the house, and occasionally at the farthest corner of the garden, which, maybe, abuts on a neighbour's backyard. The tenant is usually responsible for the removal of the refuse, although in a few cases it is a charge on the landlord; but in a large majority of cases it is allowed to accumulate for a year, when a horse and cart may economically be employed. In one place there is a group of cottages with a range of wet midden ashpits which have not been emptied for about five years, and in another some twenty loads of rubbish are accumulated, in which are buried the contents of the pan-closets, and this within 20 yds. of the back door! Many of the gardens are not large enough to permit the periodical burial of the contents of the pan-closets, and the cottagers but rarely attach any manurial value to the matter; in fact, the ground soon becomes overcharged and sick, for the area of the garden is generally in an inverse ratio to the size of the family living on the premises. A scheme for disposing of the refuse by tipping it in four old pits on the outskirts of the village, at an estimated annual cost of from £45 to £55, was submitted by the surveyor to the parish meeting, but beyond thanking him for his attendance no action was taken, the war being made the excuse for the delay. We can only repeat what we have often said before—that such a parsimonious saving of money, which is necessarily coupled with a serious menace to the public health, is not to be confused with real economy.

* * *

Housing in the East Stow Rural District.

There appears to be some difference of opinion between the East Stow Rural District Council and the Stowupland Parish Council as to whether the erection of certain cottages in the latter district ought to be postponed until after the war. The matter arose at a recent meeting of the rural district council on a letter which had been addressed to that body by the Local Government Board asking for their observations on a letter sent to the board by the parish council. It seems that in March last the consent of the board was obtained to the raising of a loan for the erection of ten cottages in the parish. Some two months later, however, the district council decided to postpone the matter, although it is alleged that overcrowding is more rife than ever owing to a large increase of labour at a local munitions factory. One member of the council gave concrete instances in support of this allegation. In one case a man and his wife, together with five daughters of ages ranging between eighteen and seven years, had to sleep in two bedrooms, while in another case five children slept in a room with only one window, which was under 2 sq. ft. in area. In these circumstances, recognising, as they have said they do, the necessity for the scheme, ought the council to postpone its execution because of the comparatively high price at which the loan would have to be raised at the present time? We venture to suggest that they would be consulting the truest interests of the parish by proceeding with the scheme without delay, and so improve the health and efficiency of the munition and other workers which must suffer seriously by the adoption of a policy of delay.

Trades Unionists and Housing.

In connection with the forty-seventh annual congress of Trades Unions, which has just been held at Bristol, a special conference was held under the immediate auspices of the Workmen's National Housing Council to discuss various matters in connection with the housing of the working classes. In the course of his introductory remarks, Mr. Will Thorne, M.P., who presided, contended that many landlords were taking advantage of the situation created by the war to make abnormal increases in rents, and subsequently a resolution was passed in favour of the establishment of Fair-rent and Security-of-tenure Courts "as an immediate solution of the evils associated with the private ownership of houses." The conference also discussed the difficult problem of the letting of municipal cottages at an economic rent. In these columns we have nothing to do with politics, and so we are accustomed to consider this question primarily from the point of view of design. The difficulties which confront local authorities in regard to this matter were admitted in a resolution which concluded by calling upon the Government to assist by making a contribution from the National Exchequer to the extent of one-fifth of any sum sanctioned by the Local Government Board for the execution of a housing scheme. In regard to rural housing, the conference passed a resolution urging the President of the Local Government Board to issue a special order to local authorities in rural districts where there is a proved shortage of cottages at once to prepare housing schemes, so that when the war is ended building operations may be proceeded with without unnecessary delay.

* * *

London University Technical Classes.

The advantages of a systematic college course of technical study as a supplement to the practical experience gained as an articled pupil are now so generally admitted that it behoves every young architect or engineer to avail himself of some of the excellent opportunities for technical education which abound in these days. On looking through the syllabus of the University of London School of Architecture, which includes the department of town planning, we are struck with the suitability of many of the courses for the requirements of the candidate for advancement in the realm of municipal engineering. Thus, in addition to purely architectural work, the school provides a certificate course in town planning, and diploma courses in that subject coupled with civic architecture and civic engineering respectively, all of which may be taken in the evenings, thus meeting the needs of those students who are engaged in business during the daytime. The department of town planning has been established in order to provide systematic courses of training for architects, engineers, and surveyors who desire to acquire expert knowledge in the laying out of towns. In the studio the different methods of draughtsmanship are fully demonstrated, not only as regards setting up, but also as regards rendering in monotone or colour, while the teaching of draughtsmanship in its higher branches will form an important part of the work to be done.

New Pavilion at Motherwell Hospital. A new pavilion, erected for the accommodation of scarlet fever patients at Motherwell Burgh Hospital at a cost of about £3,600, was formally opened a few days ago. It consists of two large wards of ten and twelve beds respectively, with five one-bed side rooms—in all twenty-seven beds with a space of 2,000 cub. ft. for each. The walls have been constructed of corrugated iron on a brick foundation in order to minimise the risk from underground workings.

Suggestions for a Test to Measure the Drainability of Emscher Tank Sludge.*

By W. L. STEVENSON, Assistant Engineer, Sewage Disposal, Philadelphia

Prior to the use of the Emscher tank, it was expected that sludge from sedimentation or septic tanks would dry slowly, and it was therefore necessary in the design of works to provide ample space to receive and retain the liquid sludge until it had dried to a consistency fit to be removed to a dump.

The thorough digestion of organic matter in the sludge compartment of a mature Emscher tank results in a destruction of the sticky, colloidal matters, a breaking down of organised bodies into finely divided particles, and a material reduction both in the volume of the sludge and in its percentage moisture. It also causes the presence of gas, which is compressed when the sludge is in the bottom of the tank, but which expands when reduced to normal pressure as the sludge is withdrawn.

This expansion causes the solid portion of the sludge to float upon the water, which, due to the above-described conditions, very rapidly separates at the bottom, as shown in Fig. 1. For these reasons, such sludge, applied to underdrained sand beds, will dry sufficiently to be removed in a few days instead of probably weeks or months with other kinds of sludge. The rapid drying permits the use of the same bed many times a year, and it is common practice to provide only 1 square foot of drying bed for each three persons tributary to Emscher tanks. Hence the drainability of such sludge has become an important matter.

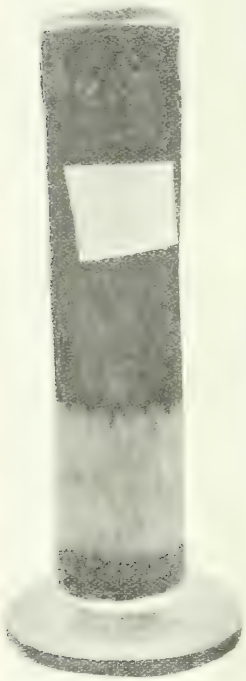


Fig. 1.

The methods of sludge analysis in most common use consist in determining the percentage moisture and specific gravity of the wet mass and the percentage of the dry residue that is fixed and that which is fat or soluble in ether. These tests are principally of value to show, in an indirect way, the good or bad qualities of the sludge, and it seems that an additional test is required to measure drainability.

The real and essential properties of sludge, when it must be disposed of on land adjacent to habitations, are odour, volume and drainability. The writer is not acquainted with any better apparatus than the nose for determining the first, a foot rule for the second, and for the third the results of a few experiments are here offered in the hope that from them a simple test may be devised.

For some time it has been the writer's practice, in order to determine the propriety of removing sludge from Emscher tanks, to withdraw a small portion, place some on a white enamelled plate, as suggested by Dr. Imhoff, and another portion in a glass measuring cylinder to see if the water would separate out at the bottom.

Since April of this year a composite sample of each batch of sludge placed on the drying beds at the Pennypack Creek sewage disposal works has been [illegible] the following procedure:—

A portion amounting to 700 c.c. is placed in a 1,000 c.c. measuring cylinder, and the amount of clear water separated at the bottom observed and recorded at hourly intervals. This is continued until the sludge begins to settle down into the water again.

Another 700 c.c. portion is placed in a vertical piece of glass tubing of the same internal diameter as the measuring cylinder. Over the lower end of the tube is secured a piece of wire screen which supports a ½-in. layer of small pebbles, a ½-in. layer of clean Jersey gravel, and a 2-in. layer of fine sand. (The thickness of these layers could probably be reduced and thereby decrease the amount of entrained drain water.)

The tube is held in a retort stand over a funnel resting in a measuring cylinder to collect the water draining out of the sludge, and the accumulated amount of water is read at hourly intervals until the sludge ceases to drain. Apparatus shown in Fig. 2.

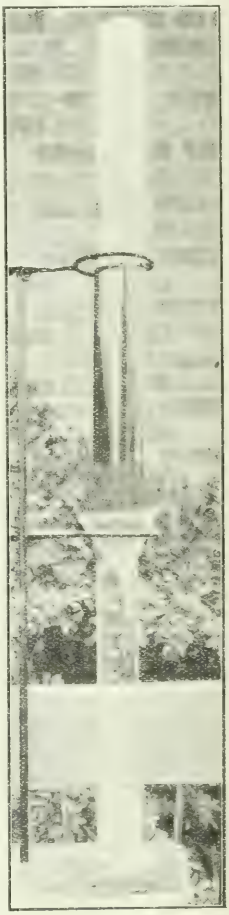


Fig. 2.

The results of the experiments are shown in Fig. 3, also the usual analyses; the number of days required for the sludge, exposed to the weather on the drying beds, to reach a consistency fit to remove; and the rainfall and air temperature during those times.

It may also be stated that sludge from Emscher tanks No. 1 and No. 2 was unsatisfactory during the early operation of the plant, and was found to be highly acid. This condition was corrected by the addition of lime water by means of a pipe extending through the ventilator to about mid-depth of the sludge.

The settling basin is constructed in two parts. Instead of cleaning the side in service when it shows bubbling, the practice is to place the other side in service and allow the sludge to digest with a small flow of filter effluent passing over it. This has resulted in a practically inodorous sludge; but the water does not drain readily as from Emscher tank sludge.

In several instances the sludge placed in the measuring cylinder has begun to float on the water, after a few hours settled down, then separated and floated again.

Such action prevents obtaining a useful curve of drainability, and it appears that the tube with filtering media is the better method.

An examination of the curves indicates that the factors which should be combined to obtain a number to represent the drainability of the sludge are:—

(*a*) The rate of drainage represented by the slope of the first part of the curve.

(*b*) The ratio between the amount of water drained from a litre of sludge and the amount of moisture

* Paper presented to the Sanitary Engineering Section of the American Public Health Association at a meeting this month at Rochester, N.Y.

therein as determined by the usual evaporation method.

(c) The time required for the water to begin to drain out.

Good sludge will be indicated by (a) having a steep slope, (b) showing a large number for the ratio, and (c) showing a short time; bad sludge the reverse.

No attempts have been made to combine these three factors to form a number similar to the relative stability figure for filter effluents, because the data are too meagre, and only sludges from the works treating a sewage which is two-thirds institutional has been used in the experiments.

But the writer believes that more extended study at some of the sewage works or testing station laboratories might develop a simple field test capable of being made by the type of operator usually found in the smaller works, and that its use would serve to indicate a very important characteristic of Emscher tank sludge.

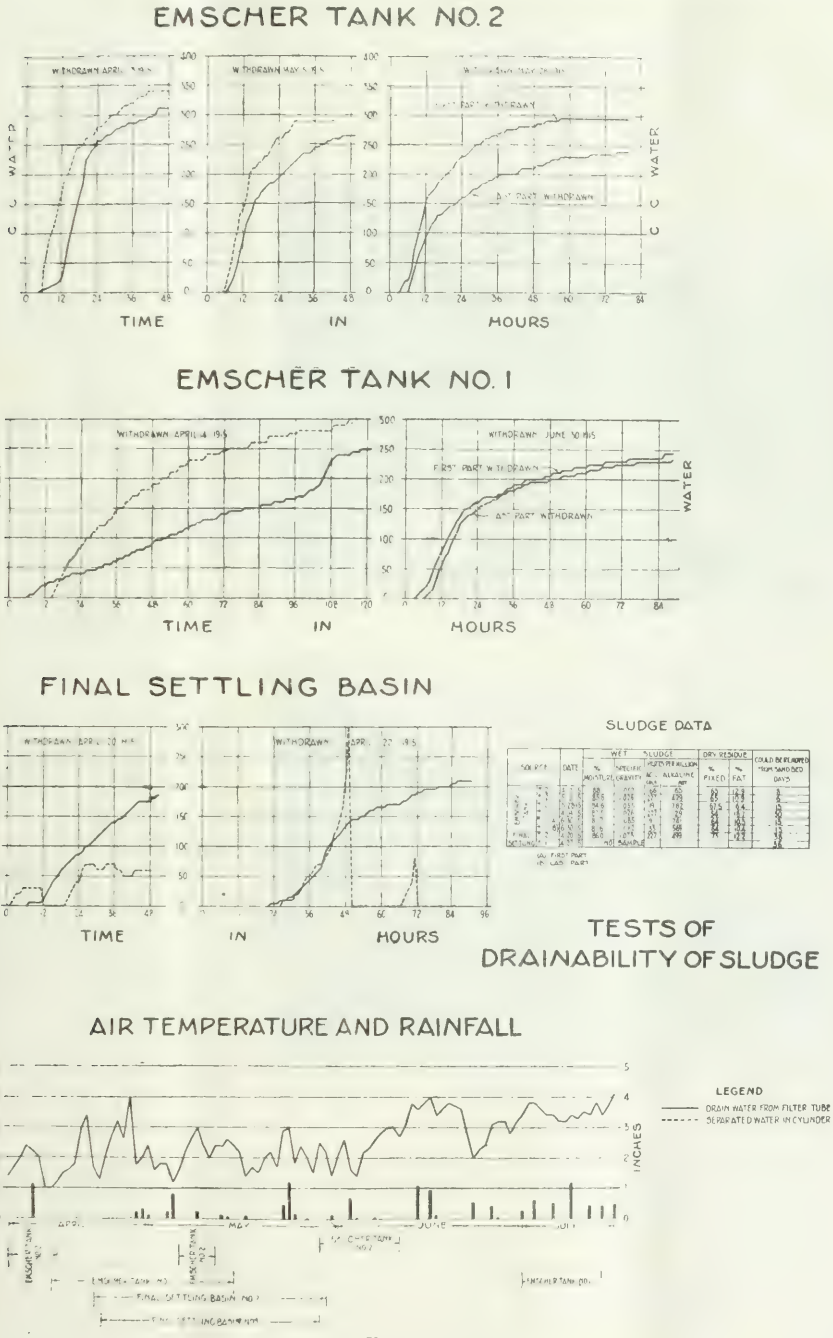


FIG. 3.

A RIVERSIDE WALL AT NEWPORT, MON.

Many years ago a masonry retaining wall of local stone was built to form an embankment to carry the roadway along Riverside, Newport, the work having been done by the landowner. Owing to the erosion of the river bank the foundations of the wall were gradually undermined. The natural result was that a part of the wall collapsed, and the remainder of the wall followed suit until practically the whole of it had disappeared. The filling behind the wall also partially vanished, as a consequence of which the roadway, which was formerly of a width of 30 ft., became so reduced that it was difficult for a horse and cart to proceed along the road. A long row of

Before Wall was Built.

After Construction of the Wall.

Newport Riverside Wall

[illegible] fronting the road, and as the erosion became worse fears were entertained that the safety of the houses themselves might be affected. After due consideration the corporation of Newport determined to take the matter in hand, and accordingly instructed the borough engineer, Mr. H. Tremelling, Assoc.M.Inst.C.E., to prepare a scheme and estimate for the construction of a new river wall.

It was decided that the new roadway should have a width of 40 ft. and a length of 900 ft., and it is hoped that when further houses are constructed facing the river the embankment will be considerably extended.

The material to be used in the new wall formed the subject of much discussion, timber, stone and ferro-concrete having their special advocates, and eventually, after prolonged consideration, the town council decided to proceed with a ferro-concrete structure on the Mouchel-Hennebique system, and adopted the scheme prepared by Messrs. L. G. Mouchel & Partners, Limited, of Westminster.

Tenders were invited, and that of Messrs. Wm. Cowlin & Son, of Bristol, was accepted. The work, which is in the nature of a reclamation by agreement with H.M. Woods and Forests Department, consisted of driving ferro-concrete piles 5 ft. apart, these being connected at the head by a coping piece, and the piles were tied back every 20 ft. into the solid ground by means of wrought-iron tie-bars secured to blocks of concrete embedded in the river bank. At the back of the piles ferro-concrete slabs were placed, the whole being backed up with hard filling.

Each pile is about 30 ft. long, varying with the depth of the river bank below the required level of the roadway, and nearly 200 piles were driven in this way. The coping is surmounted by an iron railing 4 ft. high, and two flights of steps have been provided for the convenience of the frontagers. An excellent idea of the great improvement effected is given by the accompanying views.

Ferro-Concrete—from the current number of which we extract these particulars—understands that it is hoped in the future to continue the road to Newport Bridge, and to treat it in a similar manner.

The work proceeded without undue trouble, and was completed in January this year. The specification provided that after a sufficient time had elapsed the stability of the wall should be tested by driving first in single file and then abreast three steam rollers of 14, 12 and 10 tons weight, the heaviest roller being at all times as close to the wall as it could get. This test took place on February 17th last.

The test was satisfactory in every respect, the engineers and the contractors being congratulated upon the successful outcome of what was acknowledged to be a difficult piece of work, the whole of which was carried out under the supervision of the borough engineer, with his assistant, Mr. I. F. Shellard, as engineer-in-charge. One point of special interest to municipal authorities in connection with this and other ferro-concrete contracts is that 90 per cent of the work could be and was done by local labour under expert supervision.

Salt Water for Street Watering.—At a meeting recently of the Littlehampton Urban District Council it was decided that application should be made to the Local Government Board for leave to borrow £800 for the erection of engine-house, engines and other necessary appliances for watering the roads with salt water. It was stated that by the scheme there would be a saving of £16 per annum, after allowing for the repayment by instalments of the loan and interest.

Loco. Type Boilers.—One of the series of leaflets issued by Messrs. Marshall, Sons & Co., Limited (Publication No. 948), contains an interesting photographic view of the firm's enormous boiler stockyards at Gainsborough. The company are makers of fixed and portable types of loco. boilers of from 2-n.h.p. to 60-n.h.p., and all sizes can be delivered at short notice. The pamphlet mentions that the "Marshall" patent anti-incrustation firebox is supplied without extra cost.

Newport and L.C.B. Circular.—Newport (Mon.) Corporation Works Committee have decided to reply to the Local Government Board's "economy letter," pointing out that the corporation have for some time been economising by postponing the carrying out of improvements, by stopping private street works, and in other directions; but, in view of the lavish expenditure of public moneys by Government departments in the borough alone, they find it difficult to convince their constituents of the necessity for the suggestions contained in the board's circular.

LONDON'S WATER SUPPLY.

245,000,000 GALLONS DAILY.

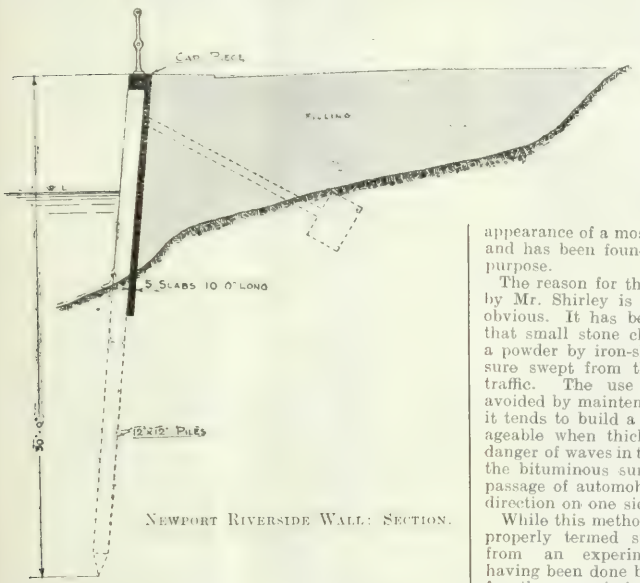
We have received a copy of the twelfth annual report of the Metropolitan Water Board.

As is fairly generally known, the board's supply of water is derived from the rivers Thames and Lee, the gravel beds near the Thames, the Chadwell Spring —which is the beginning of the New River—and wells sunk in the Lee Valley on the north of the Thames, in Kent, and certain other points south of the Thames.

The supply (direct and in bulk to adjacent undertakings) during the year was 89,420 million gallons of water, or a daily average of 245 million gallons. The grand total volume is equivalent to 399·2 million tons of water. The Thames furnished 58·5 per cent, the Lee 23·1 per cent, and the wells, &c., 18·4 per cent of this total.

The total estimated population supplied by the board at the close of the year was 6,744,247. It is estimated that 56·0 per cent was supplied from the Thames, 24·7 per cent from the Lee, and 19·3 per cent from the wells and springs.

Of the total population 65·3 per cent is north of the Thames and 34·7 per cent south of the river. The population inside London is 67·2 per cent of the whole. The daily average supply per head was 36·08 gallons, compared with 36·16 gallons in 1913-14.



NEWPORT RIVERSIDE WALL: SECTION.

STORAGE.

The effective amount of storage and subsidence reservoir capacity for unfiltered water possessed and in use by the board at the end of the year was as follows:—

	No.	Area in acres.	Capacity in million gallons.
Thames Valley	31	1,026·5	7,267·5
Lee Valley...	17	955·0	5,639·5
—	—	—	—
	48	1,981·5	12,907·0

The board are constructing a reservoir at Littleton to contain 7,000 million gallons, part of an authorised scheme to include a further reservoir to be constructed at Stanwell to contain 3,300 million gallons. Considerable variations in the design of the Littleton works have been made in order to improve the quality of the water, and to cope with possible troubles arising from algal growth.

The nett effect of the omissions and additions in the proposed works showed an approximate saving on the contract of £40,150.

The board have resolved that the supplies from the Littleton and Staines reservoirs should be so arranged as to be drawn upon as equally as possible, the intention being that the storage in the Thames Valley system is to be worked ultimately in a uniform manner so that the respective periods of storage in all the Thames reservoirs may approximate, due regard being had to periods of drought and the avoidance of double pumping.

Incidental to the construction of the reservoir it will be necessary to carry out certain works not comprised in the reservoir contract—for example, road widenings, a covered service reservoir, pumping station and plant, conduits, mains, filter-beds, &c. The cost of these will amount to a considerable sum, which, however, cannot at present be stated, as the plans are being revised by the chief engineer; but it would appear that before water from Littleton can be brought into London, works already authorised by Parliament (including the Littleton reservoir, but excluding the proposed new reservoir at Staines) will have to be executed at a cost of at least £3,000,000 on present war prices, and it is essential to the maintenance of the supply that these works should be completed within the ensuing five years.

USE OF LARGE STONE CHIPS IN THE MAINTENANCE OF BITUMINOUS ROADS.

The Maryland Highway Commission, of which Mr. Henry G. Shirley is chief engineer, after an experience with the maintenance of bituminous roads extending over several years, has adopted the practice of using stone chips at least 1 in. in size. The chips are spread over the surface of the road, at seasons of the year when the bitumen is soft, in an even layer one stone thick and rolled. The rolling forces the stones into the surface of the road until they are flush with the pavement. When completed the surface has somewhat the appearance of a mosaic. Hard blue limestone is used, and has been found to be quite satisfactory for this purpose.

The reason for the method of maintenance adopted by Mr. Shirley is (an American exchange observes) obvious. It has been universally found in practice that small stone chips are either quickly ground to a powder by iron-shod traffic or are in a large measure swept from the road surface by automobile traffic. The use of sand is now quite generally avoided by maintenance engineers on the ground that it tends to build a mat or pad that becomes unmanageable when thick, and also greatly increases the danger of waves in the pavement due to the pushing of the bituminous surface occasioned by the continual passage of automobiles usually travelling in a single direction on one side of the road.

While this method of surface maintenance, or more properly termed surface improvement, is not new from an experimental standpoint—similar work having been done by Mr. Crosby, the former engineer for the commission—its application to road maintenance work on a large scale, such as is in progress in Maryland, is an innovation. From the standpoint of the road user it possesses advantages. The exposed stones roughen the surface and reduce the slipperiness of the pavement. Slipperiness has always been a fault of bituminous treated country roads, especially since many of the horses that travel them are not sharp shod. The danger of automobiles skidding is also reduced. From the standpoint of increasing the life of the road the reduction in slipperiness permits the use of a relatively higher crown, thereby insuring thorough drainage of the surface and increasing the durability of the road, the practice of most road engineers being to use as much crown as limiting conditions will permit. In this connection it may be said that experience has demonstrated in the city of Washington that asphalt streets and roads built with a high crown have usually a longer life than those streets or roads on which less crown is used.

While the labour cost of applying large stone chips in this manner is necessarily increased somewhat, the road surface is improved by the thorough ironing out it is given by the roller. The greater availability of the supply of larger stone is also a factor worthy of consideration in many sections of the country. It is frequently difficult to secure an adequate supply of ½-in. and ¾-in. stone.

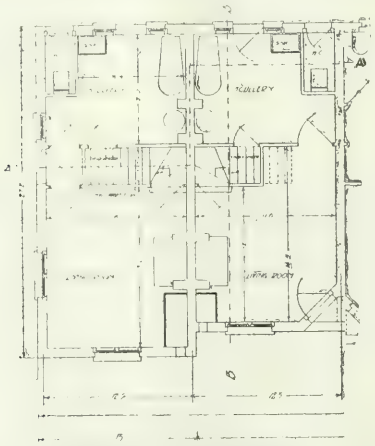
Lilian Bradshaw Fund.—We have to acknowledge receipt of 5s. from R. J.

D*

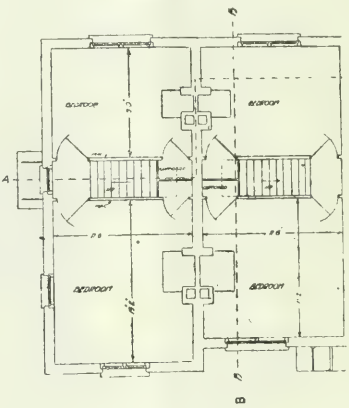
Housing at Southall-Norwood.*

By REGINALD BROWN, M.INST.C.E., M.I.MECH.E., F.S.I., Engineer and Surveyor to the Urban District Council.

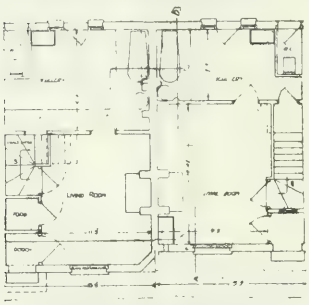
Southall-Norwood has its problems in this question to solve like other districts.



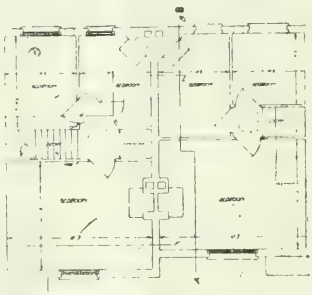
Ground Floor Plan, Class A and B.



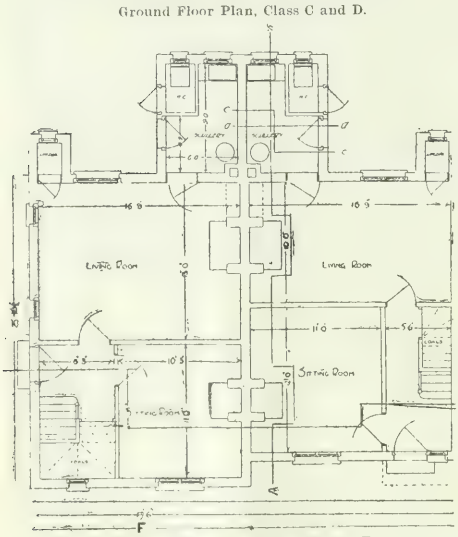
First Floor Plan, Class A and B.



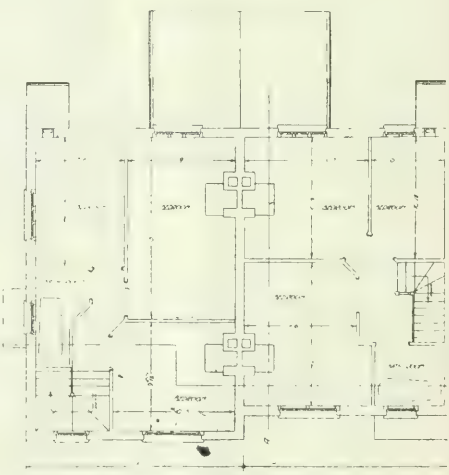
Ground Floor Plan, Class C and D.



First Floor Plan, Class C and D.



Ground Floor Plan, Class E and F.



First Floor Plan, Class E and F.

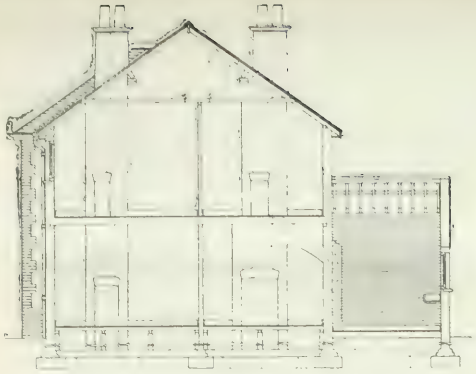
SOUTHALL-NORWOOD HOUSING SCHEME: PLANS.

In 1913 the subject was pressed on the notice of the council, and a Local Government Board inquiry was held in October of that year, extending over five days. A good deal of evidence was brought forward to show that the supply of houses was not keeping pace with the demand, and the Local Government Board, on the report of their inspector (Mr. Courtney Clifton,

* From paper read at the recent meeting of the Institution of Municipal and County Engineers at Southall-Norwood.

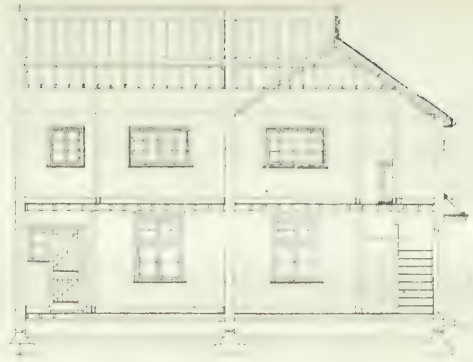
Southall-Norwood Housing Scheme. Elevations and Sections, Class A and B.

SOUTHALL-NORWOOD HOUSING SCHEME: ELEVATIONS AND SECTIONS, CLASS C AND D.



SECTION A A

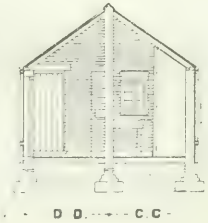
SIDE ELEVATION



SECTION B B

FRONT ELEVATION

BACK ELEVATION



SOUTHALL-NORWOOD HOUSING SCHEME. ELEVATIONS AND SECTIONS, CLASS E AND F.

M.Inst.C.E.), ordered the council to proceed with a scheme of fifty houses. To show the position of building by private enterprise, the following particulars give the number of houses for which plans were passed in each year, from 1904 to the present date (March, 1915): 1904—544; 1905—370; 1906—426; 1907—220; 1908—162; 1909—155; 1910—177; 1911—184; 1912—239; 1913—73; 1914—83. As all houses, before occupation, must be certified, accurate records are kept as to the number of houses actually erected and occupied, and the following particulars give the number of houses occupied from 1904 to the present time (March, 1915): 1904—368; 1905—332; 1906—308; 1907—362; 1908—166; 1909—133; 1910—194; 1911—160; 1912—125; 1913—111; 1914—64.

On receipt of the order from the central authority to proceed with a scheme, the council advertised for offers of suitable sites, and the author was instructed to report thereon and submit a scheme for consideration.

The site decided upon was one of about 9 acres, admirably adapted for such a scheme, it being triangular in shape and bounded on two sides by parish roads. The land cost £500 per acre. The author's ideas on housing being to limit the number of houses per acre, he decided to recommend the council to adopt a basis of ten houses per acre, and hence submitted a development showing ninety houses. One of the author's reasons for doing this was to limit the road making charges to the "lowest possible," and it may be interesting to know that a fuller development of the estate, while permitting a larger number of houses per acre, would have entailed charging higher rents to make the scheme self-supporting. The author is strongly of opinion that, with careful development, a low limitation of houses per acre, within reason, does not by any means entail higher rents being charged. In addition to this, the limitation of the number of houses has the very great advantage of securing more air space, and the author feels that the erection of such houses gives the workmen a little of "The harmony of God's own country, even in the midst of man-made town." The author is not one of those who believe that the whole of the vacant land on a building estate should be utilised as gardens for the separate houses, because it is not all the tenants who are keen on gardening, and a badly kept garden has a very deleterious effect upon adjoining gardens. He would rather see a small garden for the use of each house, divided by as few fences as possible, and those very low ones, and devote the remaining area to "open spaces," maintained by the authority out of the rates, or let as allotments to those of the tenants who desire such accommodation. It was on these principles that the design was based. [The block plan shows the scheme as a whole, with the space at the rear laid out as a public garden, and the spaces in the front of the houses built in quadrangular form, and also in front of one of the blocks were to be laid out in a similar manner.]

The scheme is arranged so that almost all the houses shall overlook the open space at the rear, and have easy access thereto. It was decided to proceed, as a first instalment, with forty-two of the houses, together with twelve houses in another part of the district. The accompanying plans show the accommodation to be provided in the various types.

The author's estimate for building these fifty-four houses, with fencing, &c., amounted to £12,675. Some considerable delay was, however, unavoidably occasioned, and it was not until just before the war that tenders were invited for the work. These tenders, on the author's recommendation, were obtained on the basis of direct purchase of materials and letting the labour by contract, in the several trades—as some of the council favoured direct labour to a limited degree, the method of carrying out the work had not then been decided upon. It was, however, of considerable satisfaction to find that, although the war had given rise to a large increase in the cost of certain of the building materials, the expenditure, even if carried out at such abnormal times, would have only been an average of £13 per house more than the estimate, and, as the increase in the price of materials accounted for at least £22 per house, it is obvious that in normal times the estimate would have been a very fair one. The rents to be charged for the houses were as follows:—

Class A and B, 6s. and 6s. 6d.; C and D, 7s. 3d. and 7s. 6d.; E, 8s. and 8s. 6d.; and these, on increased rate of interest, and a bath for each house, the income balanced the expenditure. Unfortunately, owing to the war, the Local Government Board has stopped all such schemes, and hence the carrying out of the scheme has been postponed for the present.

MUNICIPAL WORK AT NEWCASTLE-UPON-TYNE.

By W. J. Steele, M.Inst.C.E.,
City Engineer and Town Surveyor.

[We make the following extracts from Mr. Steele's report upon the work of his department during the year ended March 31st last.]

The war has affected the work of the department in several directions, since not only has the staff—both office and manual—been considerably depleted, but, owing to the very large number of troops billeted in the city, the cleansing section particularly has had additional work thrown upon it.

Of the office staff 13 have joined the Army, of whom 5 are commissioned officers, and 1, who was spending his holiday in Germany when war was declared, has since been a prisoner in that country. Of the manual staff 194 have joined the Navy or Army, and in addition a considerable number have been engaged in the local factories for the manufacture of war munitions.

With the object of temporarily replacing, in some degree, the services of those on the manual staff described above, female labour has been employed with most successful results; 50 women are engaged in street cleansing, and 11 women as collectors in the parks.

NEW BUILDINGS.

The number of dwellings erected during the year (each flat being counted as a separate dwelling) has been 163, as compared with 111 in the previous year, which was the lowest number recorded since 1882. Of the total number of dwellings erected, 87 per cent were in self-contained houses and 13 per cent in flats.

The number of unoccupied premises of a habitable nature has further declined during the year. In February, 1914, there were 336, whereas in February, 1915, there were only 152, which is about ¼ per cent of the total number of houses in the city.

The estimated cost of new buildings for which plans have been approved by the committee during the year is £396,392 compared with £491,373 for 1914.

STREETS.

Under the Private Improvement Acts, work was executed in 10 streets, having an aggregate length of 673 yds.—the smallest amount of work recorded for many years.

In 24 streets the carriageway was resurfaced with tar-macadam, the total area laid being 34,728 sq. yds.

The approximate total length of highway now maintained is 254 miles, the cost of maintenance per mile, exclusive of debt charges, after reducing the total mileage to a figure which makes the back streets equal in width to the front streets, is about £128.

During the year 136,689 tons of refuse were disposed of, 45,449 tons were deposited on tips, 42,402 tons burnt at the destructors, 27,187 tons sent to sea, and 21,651 tons sent by rail to various farms. The house refuse amounted to 94,561 tons, and is equivalent to 6·96 cwt. per head of the population, or 37·12 cwt. per house, the cost of collection and disposal being 22·03d. per head of the population, or 9s. 9·41d. per house. The street refuse amounted to 42,128 tons, and is equivalent to an average of 166 tons per mile of highway cleansed.

During the winter especially considerable complaint was made of the dirty condition of several streets. This was principally caused by the reduced staff engaged in cleansing and the increased traffic due to military operations; but even under normal conditions there are several causes which make the cleansing of the streets somewhat difficult.

One of the principal causes is the very large quantity of paper thrown on to the streets by the public. This practice, perhaps, prevails to a larger extent than in most towns, and could be prevented if more thought was exercised by the offenders. Another cause is the large amount of crushed clinker, ashes and sand spread during frosty weather, and immediately after slight rainfalls. During the year about 1,350 tons were so distributed. For a short period the quantity was considerably reduced, but had to be restored owing to the numerous complaints made by the horse owners and drivers. The anomalous procedure of the same staff of men depositing material on the streets and removing it within a few hours will probably have to be continued until either horse

The Surveyor
And Municipal and County Engineer.

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laid-on roads disappears, a much improved method of spraying tar is devised, or a non-slippery road surface, compatible with easy traction and durability, is discovered. Although of minor importance, a further cause is the material deposited from the atmosphere. The medical officer of health, in conjunction with the city analyst, have investigated the pollution of the atmosphere at the City-road testing-point. Although the deposit will vary at different points in the city, taking the figures as found at the testing-point, about 780 tons, or 31,000 cub. ft., of solids are deposited over the whole area of streets in the city during the year. A certain proportion of these solids are soluble, and will be washed into the sewers by rain, but a considerable proportion remain until collected. While the weight is insignificant, and the volume only comparatively small, the somewhat greasy condition of the streets during foggy weather is apparently due, to some extent, to these deposited solids.

In the Ouseburn Valley 72,514 loads of material were deposited in the embankment forming road No. 2 under the Corporation Act, 1904, and its vicinity; 27,852 loads were deposited by the corporation and 44,662 loads by private individuals. The total quantity deposited during the previous year was 51,403 loads.

TRAMWAYS.

The length of tramway opened for service, measured as single track, is 64¼ miles. The maintenance of the permanent way was £8,199, or £128 per mile; in addition to ordinary maintenance, £6,771 was expended in renewals, equivalent to £105 per mile; so that the total cost of the permanent way was £14,970, or £233 per mile.

Except for the shortage in labour, the cost of renewals would have been very much higher, but for the reason stated it was impossible to put many renewal works in hand. A considerable length of the permanent way is now in urgent need of renewal, and will have to be done immediately a sufficient supply of labour can be obtained. The major portion of the track has been in use for nearly fourteen years, and it is now necessary to establish a systematic renewal which will be constant.

Scarcity of Steam Roller Drivers.—At a meeting recently of the Windlesham Urban District Council, the surveyor, Mr. W. D. Bell, in relation to road repairs, said the council's contractor told him that he could not send him a steam roller, although there were six in his yard, because of the scarcity of drivers. He (the surveyor) had now succeeded in finding a retired driver living at Lightwater, who had consented to take charge of the work.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Does not the cost of scavenging in Glasgow appear to be extravagantly high when we find by the recent report of the superintendent of the scavenging department in that city that the gross cost of removal and disposal for the year ending May, 1915, had been £198,570? As it further appears from this report that the daily average of refuse, &c., amounted to 1,351 tons, may we not easily calculate that the cost of removal and disposal amounted to no less than 9s. a ton? This calculation excludes Sunday, when no doubt the Glasgow workman would not agree that cleanliness is next to godliness, and consequently no scavenging is done. How does this cost compare with that in other cities?

* * * *

Is it not rather remarkable that, notwithstanding the correspondence in THE SURVEYOR and other technical journals, the Office of Works should still persist in wasting money on the construction of carriageways in the same old-fashioned manner that has obtained for the past fifty or sixty years? What *can* be done to stop this waste of public money at a time when every penny that is wasted, either by public bodies or private individuals, means an indefinite prolongation of the war? Why cannot the Office of Works consult the Road Board as to modern methods of road construction and put a stop to this farce?

* * * *

Did the papers or discussion at the Brighton sessional meeting of the Royal Sanitary Institute on the Final Report of the Royal Commission on Sewage Disposal lead to any result? While most of us agree upon the difficulties and anomalies that beset the question of fixing a standard of purity for sewage effluents, what practical suggestion can take the place of this proposal?

* * * *

Should not the article on "Municipal Economy" in THE SURVEYOR of the 3rd inst. be widely read by all surveyors and councillors? Does not the author, Mr. W. H. Maxwell, borough surveyor of Tunbridge Wells, very wisely discriminate between municipal luxuries and municipal necessities, and point out in which directions economies could and should be followed without the least detriment to the community? Can anything be more wasteful than the planting out of parks and so-called recreation grounds with costly, perishable flowers in order to please some councillor who is a faddist on the subject and probably chairman of the Parks Committee? Has not gardening on a large scale, with other people's money, a great attraction for some people?

* * * *

Is it not refreshing to find that the sense of humour is by no means dying out in Ireland, even among county surveyors? Was it not a delightfully happy reply of Mr. Mulvaney, the county surveyor of Roscommon, when asked to reduce his estimate for building a tuberculosis infirmary and erect one on the model lines of the Irish Local Government Board, to say that he would not advise the council to spend the ratepayers' money on a building of "tin and sticks"? Who but an Irishman could have thought of such a delightful description of a temporary hospital?

* * * *

With regard to sewage disposal by aëration, which is now exercising the minds of engineers and others, would it not be possible to effect this by passing the sewage in a very thin film over a series of long weirs with flat gradients constructed of concrete? Cannot something of the kind still be seen at Teddington, where an excellent effluent is obtained, and is it not a fact that those works were constructed by a Mr. Marshall some fifty years ago?

Municipal Engineers' and Contractors' Plant.—In their new 1915 catalogue the well-known engineering firm of Murphy, Stedman & Co., Limited, 180 Gray's Inn-road, London, W.C., offer many productions which are quite fresh on the market. Municipal engineers' and contractors' plant and tools form an important part of the company's output, and our readers will find much to interest them in the particulars of road making plant, portable and stationary engines, vertical steam boilers, portable railway plant, concrete pipe and block making machines, concrete mixers, mortar mills, screens, stone-crushing machines, traction engines, trailers, and water-power plant which appear in the catalogue.

Town Planning and Sanitation.*

By WILLIAM ROSS, Town Planning Engineer, Lanarkshire County Council.

The preparation of several town planning schemes in Scotland is now well advanced, and it is the chief purpose of this paper to consider shortly the scope of some of the more important provisions of a sanitary nature being inserted therein, and how far they may meet future needs.

THE AIR SPACE ABOUT BUILDINGS.

The provisions which can be made under this head are far-reaching, and include not only the space or actual curtilage of the dwellings, but take within their ambit the important provisions regulating building lines, which for many years have been a source of trouble and annoyance. In addition, many other provisions can be secured, for example:—

A provision is being inserted to prevent the erection of buildings, walls, or other structures which, by reason of their proximity to any domestic building, would stop or impede ventilation, or would otherwise make, or conduce to make, such buildings in a condition unfit for human habitation, or dangerous or injurious to health, or prevent proper measures from being carried into effect for remedying any nuisance injurious to health, or other evils complained of in respect of such other buildings.

With regard to street building lines, these are either being marked upon the town plan or are being controlled by street cross-sections appended to the schemes, and, while they vary in width according to the height and class of building to be erected, a minimum width between buildings of 70 ft. is being prescribed in the case of one or two storey buildings. In those areas where three-storey tenements or terraces are being allowed the minimum of 80 ft. between building lines is being prescribed.

In the case of front-garden plots a minimum width of 15 ft. is being laid down.

While the distance between building lines will be defined, a provision is being inserted whereby a certain amount of latitude will be given for the variation of same where necessary for the purpose of architectural effect. The total width between building lines that could be demanded under the Burgh Police (Scotland) Act, 1892, was 36 ft., while under the present ruling (Burgh Police [Scotland] Act, 1903) the total width that can be demanded is 40 ft. to 60 ft., according to the standard adopted by each burgh authority.

In county areas the only general statute hitherto ruling linings is the Roads and Bridges Act, 1878, which only enables county authorities to enforce buildings to be kept back a distance of 25 ft. from the centre of the highway.

As regards the proportion of the site which buildings may occupy, schemes are making provision whereby dwelling-houses, except under certain prescribed circumstances, will only cover one-quarter of the site on which they are built, while shops (excluding saloons not exceeding 14 ft. high) and certain other classes of domestic buildings are only to cover one-half of the site on which they are built. It is thought provision may be made in those cases where tenements are in contemplation whereby this area will be somewhat varied in proportion to the height of the buildings.

In addition to this limitation as regards the proportion of a site which a building may occupy, a provision will be made for considerably increasing the space required at the rear of the higher classes of domestic buildings.

A provision is being inserted providing that every habitable room shall have one window at the least opening directly into the external air, and the total area of such window, or, if there be more than one, of the several windows, clear of the sash frames, shall be equal at the least to one-tenth of the floor area of such room, such window or windows to have an open space in front thereof, and within the boundaries of the site of the building of which such habitable room forms part not less across, measured at right-angles to such window or windows, than 5 ft., and such open space to extend throughout the full width of such window or windows, and be free from any erection or building of a height extending above the level of the sill of such window or windows, and providing that no building shall be erected within such boundaries, and opposite to any part of such window or windows, the height whereof, measured from the level of the sill of the window, exceeds the distance between such building and such window or windows.

A provision is being inserted regulating wing buildings in relation to windows of domestic buildings.

THE LIMITING OF THE NUMBER OF BUILDINGS THAT MAY BE ERECTED.

From a sanitary point of view one of the greatest benefits that can be obtained under the Town Planning Act is through that power given to authorities to limit the number of buildings which may be erected.

Hitherto it has in many cases been found possible to erect over 100 dwelling-houses to the acre without contravening the local authority's building by-laws. The limitation now being prescribed in schemes aims at a very much lower density than this. In the Dunfermline scheme twenty-two dwelling-houses per acre is the highest number allowed on any one acre, while the average ranges from ten to sixteen per acre.

In order that the number of buildings which may be erected will be in due proportion to the cubic contents of same, a table is appended to the scheme showing the average number of buildings of various sizes which may be built to the acre over any land unit, and the maximum number which may be built on any one acre.

It has been found essential in town-planning schemes to set up a system of land units, so that when future development or building operations are being considered it is possible to secure a satisfactory development by focussing consideration to a suitable-sized area.

By having a system of maximum and average densities over a land unit we get the necessary flexity of densities to meet the different types of buildings which may be erected.

Before proceeding with the development of any portion of an area, a plan of the proposed lay-out of the unit or units affected has to be submitted to and approved by the authority. In this way the disposition of buildings over a unit will be properly controlled.

While it will be necessary to allow a greater density of dwelling-houses per acre on the fringes of our cities, and especially where such buildings will complete units already partially developed, it is hoped even there to reduce the density down to about thirty or forty dwelling-houses per acre. The reduction in the number of houses per acre as compared with that hitherto obtaining will make it necessary for builders to adopt a more open type of development. The tenement system now obtaining in Scotland has been growing somewhat into disfavour in recent years, and the limiting of the number of houses that may be erected will tend greatly to the building of the terrace or cottage type of dwelling in preference to the tenement.

THE CHARACTER OF BUILDINGS WHICH MAY BE ERECTED.

The Town Planning Act has for the first time given local authorities power whereby they can regulate the character of buildings. In the past buildings of the factory type and of the dwelling-house class have, in many cases, been indiscriminately mixed, irrespective of those many sanitary evils following such a bad mode of development.

Town-planning schemes are now prescribing the areas that may be used for the erection of the various classes of buildings, grouping these under factories and warehouses, domestic buildings, and public buildings. In cases where it is impracticable at the outset to allocate zones for the various classes of buildings, provisions are being inserted with proper safeguards to ensure suitable zones being prescribed before development proceeds. The domestic building zones are being further subdivided in such a way as will restrict the erection of tenements and shops in relation to other classes of dwelling-houses. Definite shopping zones will be distributed over town-planning areas at well-defined centres, and these will form a nucleus to future suburban areas.

With regard to the character of dwelling-houses that

* From a paper read at the recent annual congress of the Incorporated Sanitary Association of Scotland.

may be erected, provisions are being inserted for the regulation of this. It is thought that in cities and populous areas there are already too many one-roomed dwelling-houses, and that their recognition in town-planning areas should be viewed with disfavour. The provision which has been drafted is as follows:—

"Every new dwelling-house shall be provided with at least one living room, having a floor area of not less than 144 sq. ft., containing not less than 1,132 cub. ft., and one bedroom having a floor area of not less than 132 sq. ft., and containing not less than 1,000 cub. ft., excluding presses and lobbies.

The prohibition of one-roomed dwelling-houses within a town-planning area is quite a step in advance, and at first there may be some difficulty in getting all parties concerned agreed upon the principle. If in any part of a district the need for a proportion of single-roomed houses is imperative, such buildings should only be allowed under very strict regulations. Some people consider there is a need for one-roomed houses to accommodate single persons. There is, however, a great difficulty in controlling such dwellings, and very often large families are found to be accommodated in them. A two-roomed house with necessary conveniences is considered quite a low enough minimum in view of the standard of housing now aimed at. The tendency to erect one-roomed houses will, it is feared, increase as time goes on, as there is no class of property which pays the builder so well to erect.

With regard to the height of ceilings, it has been thought proper that there should be a difference between the minimum height of ceilings required in a tenement from that required in a building of the cottage type. It is suggested that the ceilings in cottages be allowed at a height of 8 ft. 6 in. high on the ground floor and 8 ft. on the upper floors, while in the case of tenements it is suggested that the height of ceilings should not be less than 9 ft. 6 in. on the ground floor and 9 ft. on the upper floors. The difference in height of ceilings will, it is hoped, put the cottage type of building on a more equal footing with the tenement without in any way reducing it below a proper sanitary standard.

THE HEIGHT OF BUILDINGS.

The Town Planning Act gives local authorities power to limit the height of buildings within a town-planning area, and the various town-planning schemes have introduced provisions to this end.

It is proposed where four-storey tenements already exist that provisions be inserted permitting the completion of the square or block now under development to that height, subject to adequate means of ventilation; that generally three-storey tenements should be the limit in height, even for city development, and that the height be gradually reduced to two storeys as we go from the city to suburbs.

It is proposed to limit the height in a district of a rural nature to two storeys throughout, except in shopping zones, where an additional storey may be allowed. It is not proposed to limit the height of public and industrial buildings beyond controlling their height in relation to the width of the street on which they abut.

Where within a town-planning area there are existing buildings beyond the prescribed height, it is proposed to have those reduced to the height prescribed if and when they are reconstructed.

The power which local authorities have now obtained should do much to foster the process of decentralisation so much desired in our cities, and while it is not thought possible to do away with the tenement type of development, it will place this class of building on a more desirable and sanitary basis.

The limitation of height in all schemes will bear a direct relationship to the basis on which densities will be fixed, and if the density is kept reasonably low there will be less scope for high buildings. Provisions are being inserted prohibiting attic floors in tenements.

THE APPROPRIATION OF LANDS.

Very important are those provisions in a town-planning scheme which deal with the setting apart and maintaining of public and private open spaces.

Land which it is thought desirable to secure for future public open spaces at the outset is being set apart by agreement with the owners, and provision is being made for the taking over and maintaining same by the local authority as and when desired. In addition to open spaces above referred to, town-planning schemes have evolved and introduced a land unit system, through the working of which it will be possible to obtain further open spaces when development proceeds in due proportion to the density of buildings being erected. Some schemes are making provision whereby an owner will obtain certain concessions in regard to width and construction of non-traffic streets where he has set apart land for open spaces.

The number of open spaces which will be obtained free of cost in a town-planning area will depend very much on the provisions which are inserted with regard to densities, &c.

The schemes provide that where an owner sets apart to the approval of the responsible authority a public or private open space, then the number of buildings which he might have erected on the land so set apart in any land unit may be added to the number which might have been erected on the remaining portion of the unit, or added to any other unit within the same restricted area, so long as the maximum number of buildings on any one acre does not exceed the maximum governing the units so added to. In addition to those open spaces which are to be the landowner's contribution and debt to the development of his lands, provisions are being inserted giving local authorities power, where necessary, to purchase and maintain public open spaces, and for the enforcing of a proper standard of maintenance in connection with private open spaces.

Town planning schemes will have the effect of not only creating a much larger number of open spaces than we have had in the past, but the spreading of these more evenly over the areas being developed, and making them quickly and readily accessible to all classes of the community.

Special spaces are being set apart as children's playgrounds, and these, while smaller, will be in very close proximity to the area which they are to serve.

THE SECURING OF PROPER SANITARY CONVENIENCES, ETC.

While the points which have already been dealt with in the paper may be said to go to the root of many of the insanitary conditions which at present exist both in our urban and rural centres, I feel that the paper would not be complete without referring to one or two matters to which these conferences have in the past given considerable attention. It has been realised that the regulations dealing with such matters as sanitary conveniences have not been altogether satisfactory. In this connection the powers a local authority can obtain through a town planning scheme will considerably strengthen those possessed under the Public Health, Burgh Police, and other Acts.

The Scottish schemes are introducing provisions prescribing that every house shall have a proper food store or larder connected therewith, a separate water-closet for every dwelling-house, the provision of a scullery for each house, and, further, where such scullery has not a proper service of hot water and fixed wash-tubs, there shall be provided, in addition, suitable and sufficient wash-house accommodation.

A rather insanitary feature of housing which it is thought can be more adequately controlled under the provisions of a scheme is the proper regulation of recesses intended or suitable for beds being placed therein, and for ensuring suitable precautions being taken for their thorough ventilation at all times. It is suggested that one bed recess is all that should be allowed in any one room.

It is thought that suitable provisions for the prevention of overcrowding through the sub-letting of houses can be embodied in a town planning scheme, and a draft provision in the following terms is suggested:—

"It shall not be lawful to sub-let part of a dwelling-house to a separate family, or for a tenant of a dwelling-house to board or lodge any member of a separate family therein, unless the accommodation is such as will ensure an average air space for each person residing within the said dwelling-house of 400 cub. ft., and no part of a dwelling-house shall hereafter be sub-let to a separate family unless there be water-closet, larder, and washing-house accommodation for each part of a house so sub-let."

Provisions are being inserted enforcing the keeping in a tidy and sanitary condition all private gardens and private open spaces in such a manner as not to be a nuisance or annoyance to any person in the neighbourhood. In the event of failure the local authorities are empowered to do anything necessary and recover the cost from the person or persons responsible.

A provision is being inserted whereby the local

authority may require the owner of any back court or open space attached to a tenement or block of buildings or area used in common to properly pave same. Much difficulty has hitherto been experienced, especially in county areas, in having back courts kept in a sanitary condition. Powers contained under the Public Health Act have not been strong enough to ensure this.

Another rather important matter being arranged for under town planning schemes is the setting down of suitable lines for those sewers which will ultimately be required within the area, and for the setting aside of any lands necessary for the purpose of sewage purification and disposal. As the line of streets will be definitely arranged in advance, it will now be possible, when carrying through drainage schemes, to have the sewers laid along the lines of future streets in preference to the present necessity of cutting at random through undeveloped land which may ultimately be built over.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Grimsby R.D.C. (September 9th. Mr. George L. Pepler).—This was an inquiry with respect to an application for authority to prepare a town planning scheme.—The clerk, Mr. J. F. Wintringham, stated that the proposed scheme dealt with 5,865 acres of land, of which 1,935 acres were under the jurisdiction of the Glanford Brigg authority. Mr. Chambers, representing the Earl of Yarborough, the principal landowner affected (2,359 acres), said that his lordship regarded the scheme as essential for the proper development of the place. The town clerk of Grimsby, Mr. J. W. Jackson, said that the corporation was most concerned that proper and adequate road communication should be made between the places, and unless the scheme, as ultimately presented, met that requirement the corporation would reserve their right to oppose at the proper time. The Rector of Immingham, the Rev. W. M. Reid, said that Immingham was suffering because of lack of communication with the outside world. The people had to walk a mile and a-half to the electric railway, and then often had to wait forty minutes for a car. What was needed was a broad highway between the towns.

APPLICATIONS FOR LOANS.

Enfield U.D.C. £760 for the provision of a disinfecting station.

Willenhall U.D.C.— £2,500 for works of sewage disposal.

LOANS SANCTIONED.

Bury T.C. £7,225 for the provision of electricity plant.

York T.C.—£3,426 for electric cooling plant, £15,932 for general requirements in connection with the electricity undertaking, and £21,350 for tramway extension.

LOANS REFUSED.

Guildford T.C.—£10,500 for forty workmen's houses.

Oswestry R.D.C.—£350 for water main extension.

Westhoughton U.D.C. — £1,450 for a refuse pulveriser.

FORTHCOMING INQUIRIES.

SEPTEMBER.	£
21.—**Birkenhead.** For the erection of workmen's houses (Mr. Courtenay Clifton)	68,500
21.—**Northampton.** For works of sewerage (Mr. R. H. Bicknell)	3,750
21.—**Wigan.** For the electricity undertaking (Mr. P. M. Crosthwaite)	6,700
22.—**Hayes.** For works of street improvement (Mr. R. H. Bicknell)	300
22.—**Westhoughton.** For works of sewerage (Mr. W. O. E. Meade-King)	170
23.—**Newport (Salop).** For the purposes of the water supply (Mr. P. M. Crosthwaite)	300
TOWN PLANNING.	
29.—**Salford.** (Mr. George L. Pepler) ...	—
OCTOBER.	
8.—**Hunslet.** (Mr. Raymond Unwin) ...	—

CORRESPONDENCE.

Εις ἀνηρ οὐ παντ' ὁρᾶ
(One man does not see everything.)
—EURIPIDES.

Y.M.C.A. CAMP WORK.

To the Editor of THE SURVEYOR.

SIR,—Among your readers there probably can be found some men of sufficient leisure who, for quite legitimate reasons of health and physique, cannot join H.M. Forces. Still, they want to do something, but have not realised their opportunity. To those men, with your permission, I desire to issue an invitation to volunteer their services for Y.M.C.A. work in camps in the South of England. At the present time we have a number of vacancies to fill which have been occupied during the vacation by university dons, clergymen and ministers, and members of the professional and commercial classes. Most valuable service can be rendered by those who are anxious to assist at the present time our brave soldiers who in the various training camps have so nobly upheld the traditions of this country by the performance of duty under all sorts of circumstances.

On application to Mr. Basil Hewer, 13 Russell-square, London, W.C., full particulars will be given as to the nature and conditions of the vacancies which it is necessary we should fill in preparation for our autumn campaign.—Yours, &c.,

A. K. YAPP,
General Secretary.

12 and 13 Russell-square, W.C.
September 7, 1915.

MRS. BRADSHAW'S APPEAL.

To the Editor of THE SURVEYOR

SIR,—I am taking the liberty of writing and asking you if you will help me.

I have succeeded in getting my boy elected as a candidate for the Wanstead Orphanage, Essex. It is absolutely necessary that the child be placed as soon as possible.

You will no doubt know gentlemen who have influence in these matters, and would help me get votes for the Wanstead Orphanage. Will you be kind enough, for the boy's sake, to help me? I feel it useless to try to carry it through alone. The county surveyor of Stafford will do all he can in the matter for me.—Yours, &c.,

LILIAN BRADSHAW.

10 Aldergate,
Tamworth,
Staffs.
September 13, 1915.

[We have already directed attention to the circumstances of this deserving case. If any of our readers have votes for the election of candidates to the Infant Orphan Asylum, Wanstead, or are able to secure the votes and interest of other subscribers, may we appeal to them on behalf of Mrs. Bradshaw's little son? Proxies may be sent to Rev. J. H. Courte Clarke, Vicar, Tamworth; Mr. G. Midgley Taylor, M.INST.C.E., Caxton House, Westminster; Mr. E. Dodd, Corporation-street, Birmingham; Mrs. Felix Hamel, Bolehall, Tamworth; or ourselves.—Ed. THE SURVEYOR.]

THE BOGNOR MEETING.

To the Editor of THE SURVEYOR.

SIR,—In reply to inquiries received, I hope I may be permitted, through the columns of your valuable journal, to inform members of the Institution of Municipal and County Engineers who wish to attend the meeting at Bognor that the town is entirely free from air raids, and that there are no military restrictions whatever. We have had a record season, and visitors have been able to enjoy themselves as usual. I do therefore hope that those members who can get away will endeavour to do so. I shall be very pleased to give all information as regards hotel and boarding-house accommodation upon application, and the town authorities have decided to give the members a warm welcome to their district, which is one of the most progressive seaside resorts on the South Coast.—Yours, &c.,

OSWALD A. BRIDGES,
Engineer and Surveyor.

Bognor, Sussex.
September 15, 1915.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C., *and should be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

Two week answers are invited to the following questions.

500. Sewage Tank.—A sewer discharging into a sea outfall is connected to a storage tank l feet in length, b feet in breadth, and h feet in height. The tank discharges directly into the sea by means of an orifice a square foot in area, connected to low-water level by a short pipe of the same area, the top of the tank being at high-water level. Neglecting losses due to friction, and assuming that no sewage is admitted to the tank during the period of emptying, that the tide has a range of r feet, and that the tide curve is harmonic, find approximately the time taken to empty the tank. (Stud.Inst.C.E.)

501. Ventilation. In designing a system of ventilation for a public hall, what are the relative advantages of a small number of large inlet shafts, compared with a large number of small shafts; and at what level should these inlets be placed? (C. W. P., *Wellington.*)

502. Theory of Beams.—The cross-section of a beam is T-shaped, the upper table is 6 in. wide and 1 in. thick, the vertical web is 5 in. deep and ¾ in. thick. At a certain cross-section this beam is subjected to a known bending moment. Make a careful sketch to show the distribution of the stress across the section produced by this bending moment. (C. W. P., *Wellington.*)

503. Sewer Construction.—AB and CD are two 18-in. stoneware pipe sewers, intercepted at right angles by a railway in a cutting with slopes of 1 in 2. The fall of AB is 1 in 140 and CD 1 in 360. The invert level of B is 122·5; C=120·75; ground level 128·0, and level of railway metals 106·50 ft. above ordnance datum. Distance from B to C is 110 ft. Describe and show by sketches in detail how to connect the sewers AB and CD, showing provision for cleaning and inspection. The fall of both sewers is towards D. The railway company will not allow any sewer to pass underneath the railway unless at a greater depth from top of sewer to top of rails of 4 ft. (E. H., *Walkden.*)

504. Bridge Design.—A bridge is required to carry a 60-ft. street over a canal, the clear span being 40 ft., the minimum head room being 11 ft. at centre and 9 ft. at sides above normal water level. The approaches are rising gradients of 1 in 24 and 1 in 90 respectively. Sketch the bridge you recommend for such a position, giving all important particulars, short specification tests for materials, and tests for bridge when completed. (P. W., *Pontypridd.*)

505. Retaining Wall.—Design a retaining wall in reinforced concrete, giving detailed calculations. The height of proposed wall 35 ft., earth retained, dry gravel; foundation similar. (H. T.)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

498. Buttress Design.—Thirty feet (30 ft.) above the ground a rectangular buttress bears a thrust of 5,000 lb. inclined at an angle of 45 deg. If the buttress is to be 3 ft. wide, and is built of masonry 140 lb. per cubic foot, find its thickness. Also find the height of a turret 3 ft. by 3ft. necessary for stability at the top joint if the coefficient of friction=0·60. (E. P. C., *Birmingham.*)

(*a*) Resolving the inclined thrust horizontally and vertically, we have

vertical component $= 5000 \sin 45^\circ = 3635$ lb.

horizontal component $= 5000 \cos 45 = 3635$ lb.

Let d be the thickness of the wall in feet,

then weight of wall $= 140 \cdot 30 \times 3d$

$= 12600d$ lb.

The question does not state the point of application of the thrust, or whether tension is to be permitted in the buttress. It is assumed that the thrust acts at one edge of buttress, and that no tension is to be allowed.

For the vertical forces we have

$$P = \frac{W_1}{A} \pm \frac{W_2 e}{Z}$$

where P = extreme fibre stress at base

W_1 = load causing direct stress

W_2 = eccentric load

e = eccentricity of load

A = area of basal section

Z = section modulus of section

$$\therefore P = \frac{12600d}{3d} \pm \frac{3635\frac{1}{2}d}{\frac{3d^2}{6}}$$

$$= 4200 \pm \frac{3635}{d}$$

i.e., the intensity of stress at B due to the vertical forces $= 4200 + \frac{3635}{d}$ lb. per sq. ft. compression. The intensity of stress at A due to the same forces will obviously be tension if $\frac{3635}{d} > 4200$, i.e., if $d < \frac{727}{840}$, which is unlikely. However, it is the stress at B which decides the thickness of the wall.

For the horizontal force we have, treating buttress as a cantilever,

$$WL = f\frac{I}{y} = fZ$$

where W = horizontal component

L = height of buttress

f = maximum fibre stress in buttress

y = ½ thickness

I = moment of inertia of a basal section

Z = section modulus of a basal section

$$\therefore 3635 \times 30 = f\frac{\frac{bd^3}{12}}{\frac{d}{2}} = f\frac{bd^2}{6} = f\frac{3d^2}{6}$$

$$\therefore f = \frac{60 \cdot 3635}{d^2}$$ lb. per sq. ft. compression at A, and tension at B.

Then, if there is to be no tension in the buttress, tension at B due to horizontal force = compression at B due to vertical forces.

$$\therefore \frac{60 \cdot 3635}{d^2} - 4200 = \frac{3635}{d}$$

$$\therefore 60 \times 3635 - 4200d^2 = 3635d$$

$$\therefore 840d^2 + 727d - 12 \times 3635 = 0$$

$$\therefore d = \frac{-727 \pm \sqrt{727^2 + 4 \times 12 \cdot 3635 \times 840}}{2 \times 840}$$

$= 6{\cdot}2$ feet approx.

$\therefore$ Thickness = say 6 ft. 3 in.

(B. K., *Newport, Mon.*)

Calashiels' New Baths.—The public swimming baths and park and children's playground presented to the town of Galashiels by Mr. and Mrs. A. Anderson Dickson were formally opened on Saturday. The baths, which have been erected on a central site in Wilderhaugh, comprise a swimming pond, dressing-boxes, plunge baths, and spray-room, an up-to-date laundry, waiting-rooms and offices.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Hove, Warrington; housing—Newcastle-upon-Tyne; roads and materials—Fareham, Seaford; sewerage and sewage disposal—Richmond; water, gas and electricity—Lisburn.—Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Banbury T.C.—It has been agreed to build a bath-room at the isolation hospital, at an estimated cost of £132.

Barnsley T.C.—Plans have been prepared of the proposed new town hall in Church-street.

Chester T.C.—The Education Committee have purchased premises in Crook-street for the purpose of a school clinic.

Hawick T.C.—Three new plunge baths are to be provided at the public baths, at an estimated cost of £80.

Hove T.C.—The council have given general approval to a scheme for the erection of a pier as soon as the war is over, subject to full details of construction and material being submitted and passed by the council.

Hythe T.C.—It has been decided to take up a loan of £688 for works of sea defence.

Launceston R.D.C.—The question of the provision of an isolation hospital is under the consideration of the council.

Oswestry T.C.—It has been decided to erect a public convenience in Gobowen-road.

Roscommon C.C.—The council have approved and forwarded to the Local Government Board the plans of a tuberculosis dispensary, which it is proposed to build at an estimated cost of £1,400.

Warrington T.C.—A scheme has been approved for building a small-pox hospital, at an estimated cost of £1,800.

West Bromwich T.C.—On account of the war the Local Government Board have declined to sanction a loan for the whole cost of building the school clinic, but have sanctioned a loan of £988. The Education Committee propose to complete the downstairs portion, making it fit for occupation, at an additional cost of £291, and to arrange for the suspension of the contract rather than cancel it and leave the whole building standing idle.

HOUSING AND TOWN PLANNING.

Glenties (Ireland) R.D.C.—The council considered a letter from a contractor for the erection of six cottages in the district, asking the council to grant him an additional £13 per cottage to recoup him for the increased prices of material and the extra cost of labour, consequent upon the war. It was pointed out that other contractors had only been allowed £5 extra per cottage. Several members, however, reminded the council that the present applicant was one of the best contractors they had, and it was unanimously agreed to allow him £10 extra per cottage.

Kingstown U.D.C.—Mr. Thomas F. Slevin, quantity surveyor, has been selected to prepare the quantities in connection with the housing scheme about to be undertaken by the council.

Newcastle-on-Tyne T.C.—With regard to the proposed erection of 700 houses on the corporation's estate at Walker, the Housing Committee have decided to ask a deputation should interview the Local Government Board and discuss the matter.

PARKS AND OPEN SPACES.

Carrickfergus U.D.C.—It has been agreed to purchase for £100 an additional acre of land for the extension of the public park.

REFUSE COLLECTION AND DISPOSAL.

Bishop Stortford U.D.C.—The surveyor, Mr. R. S. Scott, has been instructed to purchase two slop carts at £31 each.

Oswestry T.C.—It has been decided to purchase two additional carts for scavenging, at an estimated cost of £59.

Swansea T.C.—The borough surveyor, Mr. J. R. Heath, has been instructed to report on the work of scavenging and street cleaning. Under existing conditions, he said, there could be no reduction of estimates as regarded this work, but he pointed out that they were collecting loads and loads of garden refuse and trade refuse which might be burned. In some towns the collection of trade refuse was charged for. If a general understanding could be come to on these points he believed great economies could be effected.

ROADS AND MATERIALS.

Brandon R.D.C.—Tenders have been accepted for the supply of granite as follows: Groby Granite Company, Barnham Station 13s. 9d. per ton, Thetford Station 13s. 3d. per ton; Gees Hartshill Granite Company, Barnham 13s. 1d. per ton, Thetford Bridge 12s. 10d. per ton, Thetford 12s. 10d. per ton.

Chiswick U.D.C.—Councillor Bovill reported that the wood paving of Bath-road had now been completed, and that the total cost had been £3,970, of which they hoped to get £280 for sand and ballast carted to Burlington-lane, in addition to which they had other materials. The figure given, it was stated, was not materially above the price of the tenders before the war, and was infinitely below that for similar work done elsewhere.

Fareham R.D.C.—It has been decided to construct a new road at Hill Head, and to carry out improvements at Crofton, at an estimated cost of £1,649.

Farnham U.D.C.—The Highways Committee recommend the council to accept the terms of the Road Board for the repair, during the war, of roads damaged by military traffic.

Grimsby T.C.—The town council have approved the recommendation of the borough engineer, Mr. H. G. Whyatt, that certain passages which are in a state of disrepair should be paved and made good under the Private Street Works Act.

Hove T.C.—It has been agreed to loan to the Road Board for road-making purposes one steam roller with driver and six water carts, at a charge of 27s. per day for the roller and 1s. per day for water carts.

Lewisham B.C.—In response to the request of the Road Board for the loan of steam rollers and water vans, the borough surveyor, Mr. E. Van Putten, has offered one roller and driver at 18s. per day, the board to provide fuel, oil and waste, and to pay the driver's wages, and three small water vans at 1s. each per day. The Works and Highways Committee have approved the action of the borough surveyor.

Oswestry R.D.C.—A sum of £100 has been voted for the repair of Lady Hill-lane.

Runcorn U.D.C.—It has been decided to pave part of Canal-street with Pwllheli granite setts.

Seaford U.D.C.—The council have received the sanction of the Local Government Board to borrow the required sum for repairing the roads in the district damaged by military transport.

Shipley U.D.C.—It is proposed to carry out an improvement scheme at the junction of High-street and Briggate, Windhill, at an estimated cost of £160.

Shoreham U.D.C.—The surveyor, Mr. A. W. Nye, has come to an arrangement with the Road Board for the making up of roads damaged by military traffic. The board insisted on the council carrying out the work by direct labour.

Tilbury U.D.C.—The council have approved the specifications of the surveyor, Mr. S. A. Hill-Willis, for making up part of Toronto-road.

Ulverston U.D.C.—Plans have been approved for making up Argyle-street.

Weymouth T.C.—The council have approved the plans of the borough surveyor, Mr. K. J. S. Harris, for making up Salisbury-road.

Worcester T.C.—It has been decided to apply to the Local Government Board for Provisional Orders for the compulsory purchase of property required for the

improvement and widening of High-street and St. Mary's-gate.

Yarmouth T.C.—The Road Board have offered a further loan of £778 to meet the excess expenditure on Caister-road, free of interest, to be repaid in three yearly instalments. The borough surveyor, Mr. J. W. Cockrill, reported that 109,729 yds. of roadway had been tarred, at a cost of £515, working out at just under 1¼d. per yard. The work now done would help to reduce the quantity of road making next year, and in some way make up for the departure from the practice of making up a certain number of roads each year. The borough surveyor said his opinion was that if a macadam road in good condition was tarred its life was doubled. The saving could be seen from the fact that to remake a road cost 1s. 8d. a yard, and its "life" in fair condition was four years. A road without tar cost 5d. per yard per annum, and the lengthened life by tarring reduced the cost to 3⅓d., or 25 per cent, while additional saving was effected in the less cost of cleansing, and the cleanliness and smoothness of the road were worth paying an increased price. Further work could be carried out to the amount of £600, which had been provided.

SEWERAGE AND SEWAGE DISPOSAL.

Castleford U.D.C.—It has been decided to carry out sewerage works, at an estimated cost of £30s.

Chichester T.C.—The city surveyor, Mr. F. J. Lobley, reported on the cost of the electrical alterations and repairs now being carried out at the sewage works, and was instructed to get the work done, the whole inclusive cost being £97. He also reported on the repairs required to the suction-gas plant, which would cost £15 15s. It was resolved that this work be also done.

Hexham U.D.C.—The surveyor, Mr. J. W. Pooley, has received instructions to prepare a scheme for flood prevention.

Holmfirth U.D.C.—The surveyor, Mr. G. Bray, has been instructed to prepare an estimate of cost of a sewer through Crown Bottom to the electricity works.

Richmond R.D.C.—It was reported by the sanitary inspector, Mr. Wetherell, that the War Office officials were preparing a most elaborate sewerage scheme for the military camp.

Romford U.D.C.—A scheme of drainage has been passed for the camp of the King's Royal Rifles on the Balgores estate.

South Stoneham R.D.C.—The council have referred to the Drainage Committee a report by the sanitary surveyor, Mr. W. F. Watts, as to the disposal of the sewage from the temporary pot at Swaythling. The object of a conference he had attended was to know whether the district council would deal with the sewage, and at what cost. Mr. Watts had informed the military authorities that the council would treat the sewage provided satisfactory arrangements could be made with the War Department with regard to the expenses incurred in connection with the extra pumping. It was estimated that 30,000 gallons of sewage would have to be dealt with daily. Another engine would be required at the air-compressing station, a new main and ejector, the cost to be paid by the War Department, who should also be called upon to lay their own mains, the department to pay the council £100 per year for dealing with the sewage.

Sunderland T.C.—It is proposed to carry out works of sewerage, at an estimated cost of £272.

Swindon T.C.—It is proposed to carry out extensive alterations at the Rodbourne filter-beds.

Wakefield T.C.—Plans have been approved for sewer extension in Providence-street.

WATER, GAS, AND ELECTRICITY.

Bradford T.C.—A communication has been received from the Local Government Board stating that it was proposed to hold up for the present all contracts, with one exception, which the Bradford Corporation Water Committee have at present in hand. This will mean, unless the board can be prevailed upon to modify their attitude, that the work in connection with the laying of the duplicate line of pipes from the Nidd Valley to Chellow Dean will be temporarily stopped, presumably until the end of the war. The work has already been taken in hand, miles of piping having been got ready, though the contracts for laying have not yet been placed.

Bromyard U.D.C.—It is proposed to provide a new oil engine at the pumping station.

Greenock T.C.—The accounts of the gas department for the year ended June 30th show a surplus of £1,600.

Lisburn U.D.C.—The council's solicitor has been authorised to take the necessary steps to enable the council to proceed with the carrying out of the proposed scheme for extending the water supply, in accordance with the Provisional Order obtained for that purpose.

Newtownards U.D.C.—In order to meet the extra cost of materials, it has been decided to increase the price of gas by 5d. per 1,000 ft.

Ripley U.D.C.—The council have resolved to ask the Ilkeston and Heanor Water Board if they would supply 30,000 gallons of water per day at 9d. per 1,000 gallons.

St. Pancras B.C.—Despite the street lighting restrictions, the electricity undertaking is in such a satisfactory condition that the council are recommended to utilise £6,413 of the profits for the relief of the rates for the current winter half-year. In the corresponding period last year the amount allocated for the same purpose was £13,000.

Swansea T.C.—The Electricity Committee have approved the scheme of the electrical engineer, Mr. Burr, to meet the increased cost of production owing to the war, which amounts to about £4,400 for the year. The proposal is to raise the charges for electricity, coupled with a charge in future for meter rent ranging from 2s. to 10s. per quarter. He estimated that this would bring in increased revenue of about £3,300, which, together with the profit based on the previous year, would meet the increased cost.

Wakefield T.C.—The Local Government Board have sanctioned the provision of a boiler-feeder pump and a cooling tower in connection with the electricity undertaking.

MISCELLANEOUS.

Chatham T.C.—The council have resolved to purchase a steam tractor and two trucks, at an estimated cost of £623.

Portrush U.D.C.—Complaint was made as to the nuisance caused by people who occupied vans and carriages at Dhu Varren in the summer season. It was stated that the council had the power of making by-laws for the promoting of cleanliness and the prevention of nuisances, but no power to enforce such by-laws. Actual nuisance would require to be proved, and the vans would have to be so substantial as to be classified as a house before a prosecution could be sustained. After discussion, the matter was postponed *sine die*.

Whitby R.D.C.—A long-standing dispute with reference to the foreshore rights between Upgang and Newholm Beck having been settled in favour of the Crown, the Board of Trade are making arrangements with the North Riding County Council for that body to be the controlling authority. Some members of the rural council expressed concern at the conditions which the county council are likely to impose with respect to the removal of sand, gravel, and shingle from the beach. This has previously been obtained in almost unlimited quantities at a minimum charge, or even for nothing. It was decided to rescind a previous resolution of the council, and to apply to the Board of Trade for control of the foreshore.

FOR OTHER ADVERTISEMENTS
See End of Paper.

MATLOCK URBAN DISTRICT COUNCIL.
STEAM ROAD-ROLLER DRIVER.

The above Council invite applications for the appointment of Driver for their Compound Steam Road-roller, temporary during the war.

Applicants must be steady, thoroughly experienced in driving, and one accustomed to driving in a hilly district preferable.

Wages 30s. per week. The person appointed must make himself generally useful in other work when not engaged in rolling.

Applications, endorsed "Roller Driver," stating age and experience, accompanied by copies of three recent testimonials, and stating when could commence work, must be delivered to me, the undersigned, not later than 12 noon on Monday the 4th day of October, 1915.

JOSEPH TURNER,
Engineer and Surveyor.

Town Hall, Matlock.
September 14, 1915. (2,722)

HARTSHORNE AND SEALS RURAL DISTRICT COUNCIL.

INSPECTOR OF NUISANCES AND SURVEYOR OF HIGHWAYS, &c.

The above Rural District Council invite applications for the appointment of Inspector of Nuisances and Surveyor of Highways, &c., for their district, at a salary of £150 per annum, to include travelling expenses.

The Rural District comprises Eight Parishes, covering an area of 11,571 acres, and a population of 7,939.

The Officer will be required to perform all the duties imposed upon Inspectors of Nuisances by the Public Health, Housing and Town Planning, and other Acts, and by the Orders of the Local Government Board. He must have a competent knowledge of building plans, and be able to prepare plans and specifications for, and to superintend the carrying out of small drainage and sewerage works. He will be required to give his whole time to the performance of his duties.

The appointment of Inspector of Nuisances will be subject to the approval of the Local Government Board.

Applications, in the handwriting of the candidates, stating age and qualifications, with copies of not more than three recent testimonials (which will not be returned), must be sent to me on or before Friday, the 24th September instant.

Notice will be sent to any candidate required to attend before the Council.

Canvassing, either directly or indirectly, is strictly prohibited, and will be deemed a disqualification.

(By order)

GEORGE FARMER,
Clerk to the Council.

Ashby-de-la-Zouch.
September 15, 1915. (2,721)

SUTTON-IN-ASHFIELD URBAN DISTRICT COUNCIL.

SUTTON-IN-ASHFIELD SEWAGE DISPOSAL.

CONTRACT No. 1.

The Sutton-in-Ashfield Urban District Council invite Tenders for alterations to existing sewage tanks; also the construction of new screening chamber, settling tanks, and 1¼ acres of rectangular bacteria beds, together with humus tank, engine-houses, office and other incidental works, in accordance with the Drawings and Specification prepared by the Engineers. Drawings and Specification can be seen, and Bills of Quantities obtained, on application at the office of the Engineers, Messrs. Willcox & Raikes, of 63 Temple-row, Birmingham, on or after the 1st day of October, 1915, on payment of a deposit of £5 5s., which will be refunded on receipt of a *bonâ-fide* Tender and the return of all documents to the Engineers.

Sealed Tenders, in envelopes supplied, endorsed "Sutton-in-Ashfield Sewage Disposal (Contract No. 1)," to be delivered at my office not later than 12 o'clock noon on the 30th day of October, 1915.

The Council do not bind themselves to accept the lowest or any Tender, and reserve the right to defer commencing the intended works till after the war, or until such time as they may determine.

JOHN D. FIDLER,
Clerk to the Urban District Council.

Sutton-in-Ashfield,
Notts.
September 15, 1915. (2,720)

ASPHALTE CONCERN, North of England, Manufacturing Mastic Rock Asphalte, Bitumens—Trinidad, Electrical, &c.—wishes to get in touch with those having extensive practical experience and knowledge of above with view to arranging for intermittent consultative services.—Address Box 1,539, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (2,715)

PRACTICAL TRADESMAN, diploma Sanitary Inspection Science, would like short time with Surveyor to learn a few points; near London preferred.—State terms to be paid, Box 1,541, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (2,723)

PERSONAL.

Mr. W. R. Bailey, surveyor to the Holbeach Urban District Council, has been killed in action in France.

Mr. J. S. Mant, deputy surveyor to the Southwick Urban District Council, has joined H.M. Forces.

Mr. John Wilson, borough engineer and surveyor of Bacup for many years, died recently, we regret to state, aged seventy-four.

Mr. Ellis Harrison, surveyor and clerk to the Royton (Lancs) Urban District Council, has had his salary increased by £28 per annum.

Mr. G. Spurr, assistant surveyor of Pontefract, has been appointed surveyor to the Halesowen Rural District Council, at a salary of £160 a year.

With reference to the announcement last week that Mr. A. E. Brookes, county surveyor of Durham, had been appointed to superintend Government road-making operations, we are informed that the real facts are that the Durham County Council have been approached by the Road Board to lend Mr. Brookes to act as resident engineer in connection with the construction of roads required for military purposes in the Southern Command.

Mr. Stanley Hill, son of Mr. J. Hill, of Durham Cottage, Shepperton, who is practising an an architect in New Zealand, has been successful, in collaboration with his partner, Mr. A. Garnett, in preparing the winning plans and designs, in open competition, for the new municipal building at Hastings, New Zealand. The new building, which will be in what is termed Colonial classic style, is of two storeys at the junction of two important streets, with frontages of 198 ft. and 78 ft., and will cost when completed £14,000.

Mr. Frank C. Loades, P.A.S.I., associated member Town Planning Institute, late town planning assistant at Derby, has been appointed by Prof. Patrick Geddes as assistant director of the Cities and Town Planning Exhibition, which is being taken out to India by Prof. Geddes. The tour will last seven months, and during this time many Indian towns will be visited, the principal one being Calcutta. The party will sail to-morrow on the s.s. "Mongolia." Mr. Loades was formerly chief assistant to Mr. Thos. Adams, now chief town planning adviser to the Canadian Government, and subsequently to Mr. Geo. L. Pepler, now assistant town planning inspector to the Local Government Board.

Mr. R. O. Wynne-Roberts, M.INST.C.E., has discontinued practising as a consulting engineer at Regina. He has now opened an office at 310 Temple-Building, Bay-street, Toronto. Mr. Wynne-Roberts' experience in municipal engineering and administration extends back over thirty-two years, when at the age of eighteen he was appointed assistant town engineer of a well-known holiday resort in North Wales, and made responsible for practically all the engineering work carried on by the municipal authority. These included waterworks, gasworks, sewers and roads, both new construction and ordinary maintenance, employing about 150 men. This appointment he held for seven years. During these thirty-two years Mr. Wynne-Roberts has been associated with almost every kind of municipal undertaking in Great Britain, South Africa and Canada. Apart from important work he had in hand as city and water engineer of Cape Town during the years 1898 to 1907, such as waterworks, street improvement, and so forth, employing about 2,500 men, Mr. Wynne-Roberts had to undertake the first part of the work of stamping out bubonic plague, which had broken out during the Boer War. Mr. Wynne-Roberts' experience in Canada has been an interesting one. In 1911 he was engaged by Mr. A. J. McPherson, then city commissioner of Regina, now chairman of the Saskatchewan Local Government Board, to investigate and report on the question of augmenting the supply of water. Mr. L. A. Hornton succeeded Mr. McPherson as city works commissioner, and it was with him that Mr. Wynne-Roberts was associated as consulting engineer in connection with the many schemes that were under consideration from time to time by the city authorities.

Road-making Experiment at Cardiff. — Experimental tests in road construction are being carried out by the city engineer, Mr. W. Harpur, on a stretch of road in Cathays Park.

Shrewsbury Housing Scheme.

SIX TYPES OF DWELLINGS.

At [illegible] on Monday Shrewsbury Town Council had before them a report of their committee on the financial aspects of their Wingfield Gardens housing scheme, whereby [illegible] sixty-three [illegible] 137 seven with three bedrooms and six with two bedrooms have been provided. At the same time the Housing Committee submitted to their property and second scheme prepared by the borough surveyor, Mr. A. W. Ward, ASSOC.M.INST.C.E.

The site proposed, which is 7·6 acres in extent, is at Castle Fields, and lies between New Park-road and [illegible]. About 7 acres is obtainable at the price of £200 per acre, the remainder of the land is the property of the corporation.

In submitting to the committee a general plan showing the proposed method of laying out the land, together with draft plans, sections and elevations of various types of houses, and a financial statement which he had prepared with the assistance of the borough accountant, the borough surveyor furnished the following outline of his scheme:—

The number of houses to be erected will be 100.

The site being, approximately, 7·6 acres in extent, the houses will be disposed on the site in the proportion of 13⅛ to the gross acre. In this connection it should be pointed out that the houses are distributed more or less evenly over the whole area.

The houses will contain accommodation and be let as follows:—

No. of Houses.	Accommodation.	Rent per week.
12	Living room, scullery and 2 bedrooms	4·6 including rates
80	Living room, scullery and 3 bedrooms	5·– including rates
8	Parlour with bay window, living room, scullery, 3 bedrooms and bathroom	5·9 plus 1·9 rates

The rates can be compounded in the case of the ninety-two houses to be let at 4s. 6d. and 5s. Every house will contain a bath, water-closet, coal store and pantry, the baths in the ninety-two houses referred to being placed in the sculleries, and being fitted with wooden flaps over them to form tables when not in use.

The houses will be of various types; the variation will assist in the beautifying of the suburb.

The accompanying table gives the sizes of the various rooms in the various types of houses.

The financial aspect of the scheme is as follows:

TOTAL COST.

	£
Buildings:—	
12 houses at £170	2,040
80 houses at £190	15,200
8 houses at £230	1,840
100	£19,080
Land:—	
7 acres at £200 per acre £1,400	
Law costs, stamps, &c. ... 50	1,450
0·6 acres, owned by Corporation at present	—
Street works, sewerage, and laying out ...	1,500
	£22,030

TOTAL ANNUAL INCOME.

	£	s.	d.
12 houses at 4s. 6d. per week, clear...	119	8	0
80 houses at 5s. per week, clear ...	1,040	0	0
8 houses at 5s. 9d. per week (occupier paying own rates)...	119	12	0
	£1,300	0	0

TOTAL ANNUAL EXPENDITURE.

	£	s.	d.
Buildings:—			
£19,080 at £4 8s. 4d. (4½ int.) for 60 years	813	5	9
Land and costs:—			
£1,450 at £4 3s. 7½d. (4¼ int.) for 80 years	60	12	7
Street works, &c.:—			
£1,500 at £7 12s. 3½d. (4½ int.) for 19 years	111	3	9
Total annual loan charges on the annuity system	£1,018	2	1
Rates:—Compounded on 4/5 rateable value			
Poor rate: 92 houses at 4s. 4d. in the £, less 30%, £1 4s. 3d. per house	111 11	0	
Improvement rate: 92 houses at 2s. 1d. in the £, less 50%, 11s. 4d. per house	52 2	8	
Water rate: 92 houses at 5% on 4/5, less 25%, £2 per house	27 12	0	
	191	5	8
Fire insurance:—£19,000 at 1s. 6d. ...	14	5	0
Repairs:—100 houses at 10s. per house ...	50	0	0
	£1,273	12	9
Credit balance ...	26	7	3
	£1,300	0	0

With regard to the proposed twelve houses containing two bedrooms only, the Housing Committee consider, from their experience of the Ditherington scheme, that there is a distinct demand for such dwellings for the accommodation of old people and people without families, though they agree that the large majority of the houses should contain three bedrooms. They also consider that there is a demand for houses of a somewhat better class, and are therefore recommending [illegible] eight of such houses.

Having regard to the urgent necessity for additional

CASTLE FIELDS, SHREWSBURY, HOUSING SCHEME. ACCOMMODATION IN SIX TYPES OF DWELLINGS.

Type's Number.	Rent.	Parlour.	Living room.	Scullery.	Chief bedroom.	Second bedroom.	Third bedroom.
	s. d.	feet.	feet.	feet.	feet.	feet.	feet.
A—14	5 0	—	14 × 11	8 × 7	14 × 10	10 × 7½	7½ × 7
B—12	4 6	—	13 × 11	11 × 6	13 × 11	11 × 9	—
C—6	5 0	—	16½ × 10	11½ × 5½	16 × 9	11 × 8	8 × 7
D—36	5 0	—	14 × 11	9 × 8½	11½ × 10½	11½ × 7½	8½ × 7
E—8	5 6	10 × 9	14 × 10	8 × 6	11 × 10	11 × 9	9½ × 8
F—24	5 0	—	13 × 10½	8½ × 8½	15 × 10	11½ × 7½	8 × 7

[illegible] a scheme of this kind in the town, the committee of March last [illegible] recommended the council to approve the scheme, and to authorise the completion of the detailed drawings in order that application may be made to the Local Government Board for a loan.

The recommendation was unanimously agreed to.

Lighting of Public Libraries. At the last meeting of the Weston-super-Mare Urban District Council, the Free Libraries Committee reported that they had considered tenders from the local gas and electric lighting companies for the lighting of the ground floor of the Free Library, and recommended the adoption of electric light on account of "the improved atmospheric conditions which may be expected from its use and also from the point of view of preservation of the books." The recommendation was adopted.

A Glossary of Road Terms. By H. Percy Boulnois, M.INST.C.E. St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, E.C. Price 2s.—Mr. Boulnois has achieved far more than he may imagine by this production of his pen. He set out to standardise the nomenclature of road terms; in addition he had made a valuable addition to English literature. To the untutored it is like reading a new language; Mr. Boulnois says it isn't anything like "complete." At any rate, it is a valuable *vade mecum* which no one has attempted before.—*Portsmouth Times.*

Sewage Works Operation and Analytical Methods.

In our issue of January 1st last we reproduced tables in which were set forth tests recommended by a committee of the Sanitary Engineering Section of the American Public Health Association as the most useful for operating control and for determining the efficiency and sufficiency of the treatment of sewage. During the past year there has been no adverse criticism of these tests, nor have any others been suggested. In a report presented this month at a meeting of the association held at Rochester, New York, the committee reaffirm the advisability of the use of these tests as far as possible in all laboratories connected with the operation of sewage treatment works, for, in addition to their usefulness, it is considered that general adoption would make possible comparison of results of operation from published reports. This, the committee add, does not mean that other tests should necessarily be abandoned, for that, they point out, would interfere with comparisons between past and present results of operation, which would be disadvantageous for local purposes. The report referred to, which is signed by Messrs. Lewis I. Birdsall, F. E. Daniels, C. A. Emerson, junr., C. B. Hoover, H. C. McRae, Richard Messer, and W. L. Stevenson (chairman), contains the following observations.

The volume of sewage in America which must be taken care of is increasing rapidly each year. This is attributed to the natural growth of cities and towns, and is also due to the general demand for complete sewerage facilities throughout the country, which requires the installation of new sewer systems and the extension of existing ones. These conditions add steadily increasing loads upon the watercourses, while their ability to receive the sewage does not increase and in some cases actually decreases; consequently, the pollution of watercourses is becoming more evident, and in many instances has gone beyond safe limits.

The continued increase of urban population throughout the country compels the municipalities to depend for the most part upon the large surface streams for sources of water supply. Certain pathogenic bacteria contained in sewage—notably those causing typhoid fever and certain forms of dysentery—are capable of surviving for considerable periods in water, and even after being transported for many miles by stream may produce disease if again taken into the human system.

The people at large are waking up to the importance of maintaining our rivers and streams in a reasonably clean condition, so that they may serve as proper sources of water supply and be useful for both industrial and pleasure purposes. To conserve these natural advantages sewage treatment works are being constructed all over the country, and these in the aggregate represents the investment of large sums of money.

It is therefore surprising to learn how few sewage works in America are under competent supervision and provided with laboratory facilities; in fact, only a few of the larger plants receive such attention.

In the case of water purification plants, the public in general demands that the works shall be operated with skill and that the product delivered to the consumer shall be the best that can be obtained with the available facilities. This is only natural, as a deterioration in quality, even though it be for only a short period, is apt to have a direct and deleterious effect on the health of the community. On the other hand, inefficient or careless operation of sewage treatment works does not, as a rule, give rise to a storm of protest unless the error is so great that it is apparent to the most casual observer.

One of the reasons for this lack of interest on the part of the public is that in many cases sewage treatment works are installed for the good of the commonwealth, and the citizens of the town do not personally realise the resulting benefits. Another reason lies in the fact that sewage works are frequently objectionable and untidy; this is due to the lack of appropriation of sufficient funds for maintenance, and sometimes to carelessness.

With modern processes and proper operation it is possible to reduce objectionable sights and odours to such a point that only a prejudiced visitor will be dissatisfied. A reasonable amount of money spent in laying out flower beds, shrubbery and trees, and in taking care of the grass walks will be more than returned in the added interest in the plant by its operators and by the citizens.

Your committee begs to call the attention of designing engineers to the importance of including the sodding or seeding of slopes and planting of trees and shrubs in the contracts for the construction of sewage treatment works, for new works are too often left in a very unsightly condition with respect to landscape embellishments.

Municipalities frequently employ expert engineers to study local conditions and to design sewage treatment works, but when such works are put in service their operation is entrusted to an untrained employee, transferred from some other branch of the service, who is totally lacking in knowledge of the complex forces which must be controlled in order to produce the results which the designers intended, and for which the funds were invested.

This is poor business policy; a municipality or private owner would not attempt to operate a power plant or other installation involving complicated machinery without the services of trained engineers, because they know it would not be economical to do so.

Need for Laboratory Control.

Where sewage treatment works are of sufficient size to warrant it, laboratory control will allow improvements in methods of operation whereby failures may be averted, and the capacity of the plant maintained to an extent which will more than pay for the small expense involved.

In the case of a small works the expense of an individual laboratory will usually be prohibitive. However, if there are several such plants in the same neighbourhood it may be possible to obtain the services of an expert operator, provided with a laboratory, to look after all of them, and the expense, divided among the several communities, would be very small. It is recommended that designing engineers call the attention of their clients to the necessity and economy of such operating control.

Central Authority Advisable.

As the great majority of sewage treatment works in America are small and frequently widely separated, it is apparent that the needed expert supervision cannot be obtained locally, and that efficiency of operation can only be obtained through some central authority.

In several states the legislatures have empowered the State Boards of Health with authority to control the pollution of watercourses, and their approval is required before sewerage works can be constructed.

The State Board of Health, in its uniform relation to all the municipalities of the State, and with similar boards in adjacent states, is in a position to perform such a service to better advantage than any other body now existent in the usual organisation of the various state governments of the country. The problem is not for the national government, as the operation of sewage treatment works requires oversight by individuals familiar with local needs, characteristics and possibilities, and stationed within a few hours' travel of the local works, in order to be of service in case of emergencies which require immediate attention or advice. On the other hand, except in scattered cases, the unit of the county appears to be too small.

In municipalities where sewage treatment is entrusted to competent expert employees, and where this work has the strong moral and financial support of the citizens, the exercise of state authority and supervision is but little needed; but in such cases the co-operation of state and municipal officials is of mutual advantage.

For the State Boards of Health to act intelligently they should know the methods of operation and results

established at all the sewage treatment works in the state. They would then be able to act as clearing-house, applying to our works the information obtained from several others operating under similar conditions. Such information must, of course, be applied to any particular works by one who is thoroughly conversant with local conditions and able to distinguish the peculiarities and differences involved. The operation of each works is a purely individual matter. Blindly copying, without due analysis of the local conditions, is generally fatal.

This would in no way encroach upon the province of the private or consulting engineer; on the contrary, it would be to his advantage.

The State is interested in seeing that the existing works accomplish the best results possible, and the separate communities are naturally anxious that the works shall meet the requirements at the minimum expense for operation, additions and renewals.

DATA REQUIRED.

To obtain these data, information is required on the following:

(1) The purpose of the works—*i.e.*, are they primarily intended to protect sources of water supplies, or to prevent the creation of nuisance?

(2) The construction of the works—*i.e.*, the details of each process which influence operating methods rather than the stability of the structure.

(3) The quantity and character of the sewage to be treated.

(4) The methods of operation and results accomplished.

The data concerning the construction of the works should be obtained by the State Board of Health, either through plans submitted for approval supplemented by record plans after the works are constructed, or, in cases where the board is not yet clothed with such authority, by means of inspection and measurement. Any changes from the original contract drawings or alterations after the plant is in service should be especially noted, as these may be vital information in connection with operating policies.

It is presumed that in those states where the law does not require approval of sewerage works before construction, the number of plants is small, and hence there should be no difficulty in obtaining the needed data.

The records of operation and results accomplished should be furnished the state by the town or owner upon blank forms prepared by the town officials or the owner in conjunction with the state officials.

REPORT FORMS.

It is practically impossible to recommend a standard form of report blank to cover all the many types of apparatus used in sewage treatment. If, however, the report form for each works in a state is prepared to meet the local needs, it can still contain essential data so recorded that reports of operation of similar types of apparatus in different works will be in identical form for comparison.

In preparing such forms it should be borne in mind that the small works are generally operated by employees lacking a technical education, and therefore clearness and simplicity should be obtained by having as much as possible printed, leaving only figures to be filled in.

The reports should be printed on sheets either 8½ in. by 11 in., or of such size as to conveniently be folded to 8½ in. by 11 in., so as to facilitate filing in standard letter files. It would be desirable to have the sheets made up in the form of pads, so that the operator by placing carbon paper beneath the top sheet could obtain a copy.

The record sheets should be signed by the operator and mailed at monthly intervals to the office of the State Board of Health.

It is again desired to call attention to the importance of recording essential data. In the majority of sewage treatment works no provision is made to obtain a record of the rate of flow to the plant, even though such information is vital to proper operation. The committee strongly recommends that engineers in designing new works provide means for easy measurement of the flow, and that measuring devices be installed in existing works not now so equipped.

When the record forms are printed, blank spaces should be left at convenient places where it may be desired to put figures resulting from computations by the state authorities.

For example, if the operator reports that sludge was placed on drying bed "D" to a depth of 7 in., the state official, knowing from the records the area of the bed, can compute the number of cubic yards of sludge, which he would enter in the blank space mentioned.

RESULTS WHICH CAN BE OBTAINED BY ADOPTING THESE RECOMMENDATIONS.

If this system of obtaining data were to be put in force, in a short time the state officials would be in possession of a fund of information which could be used in advising operators of sewage works, and this would not only aid the local communities, but also the commonwealth.

When sewage works are operated without producing nuisance, and at a reasonable expense, the objection on the part of communities to being compelled to instal works will diminish, for the fear of failure will be lessened.

It would be of further advantage if the State Boards of Health would use the information so gathered to prepare pamphlets, written in clear, popular style, to call to the attention of town officials the need for and value of sewage treatment not only as a local matter, but in its broader effect upon the commonwealth.

Electricity Scheme for Ireland.—A company is seeking Parliamentary powers to employ the falls of Loch Erne, at Belcak, and of the Shannon, near Limerick, for electricity purposes in Ireland. Mr. Theodore Stevens is the consulting engineer, and Mr. P. J. McAndrew, Sheen Lodge, Bundoran, superintending engineer, with Mr. Blayney Winslow as secretary.

Glasgow Corporation's New Water Supply.—The Glasgow Corporation Water Order, providing for the inclusion of the river Turk watershed in the Loch Katrine area of supply will, it is expected, receive the Royal Assent with the reassembling of Parliament. The corporation have secured the entire ownership of the new lake, extending to over 400 acres, and a belt of land round the lake for present and future requirements. It is estimated that at least 15,000,000 gallons daily will be obtained from the new source of supply.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. H. T. Wakelam, M.Inst.C.E., County Engineer of Middlesex.

SOUTH-EASTERN DISTRICT.

A South-Eastern District meeting will be held at Bognor on Saturday, September 25th.

PROGRAMME.

11.30 a.m.—Meet at Congregational Institute, London-road, where Mr. H. H. Gibbs, J.P., chairman of the Bognor Urban District Council, will receive the members.

Read minutes of previous meeting.

Paper on "Bognor Municipal Undertakings," by Oswald A. Bridges, M.R.San.I.

Discussion.

1.30 p.m.—Luncheon by the kind invitation of the chairman of the Bognor Urban District Council (Mr. H. H. Gibbs) at Normanscroft, Sylvan-way.

3 p.m.—Visits to the various works (new housing scheme, new sea defence scheme, site of new sewage works, hospital, and underground convenience) described in the paper.

Mr. Oswald A. Bridges has kindly offered to arrange the following drives if members desire, provided they notify the hon. district secretary that they wish to take part not later than the 18th inst. Particulars of the starting-point, cost, &c., will be supplied to such members at a later date.

Saturday, September 25th.

4 p.m.—Motor charà-banc drives to Arundel and Chichester.

Sunday, September 26th.

10.30 a.m.—Motor drives to Midhurst, Liphook and Hindhead.

J. L. Redfern,
Hon. District Secretary.

Gillingham.

TOWN PLANNING INSTITUTE.

ARRANGEMENTS FOR 1915-16 SESSION.

A meeting of the Town Planning Institute will be held on September 24th at 92 Victoria-street, Westminster, S.W. (by kind invitation of the Institution of Municipal and County Engineers), at 8 p.m., and it is hoped that this the initial meeting of the Winter Session will be well attended.

The arrangements for the session are as under:—

September 24th. Opening address. By Raymond Unwin, F.R.I.B.A. (M.), president.
"Town Planning Literature." By Patrick Abercrombie, M.A., A.R.I.B.A. (M.).

October 15th.—"The Placing, Design, and Arrangement of Railway Terminals." By James Crossland, L.R.I.B.A.

November 5th.—"Limited Owners and Town Planning." By J. S. Birkett, M.A. (L.M.).

December 10th.—"Arterial Roads in Greater London." By W. R. Davidge, F.S.I., ASSOC.M.INST.C.E. (M.).

January 14th.—"Open Spaces and Town Planning Schemes." By Lawrence W. Chubb (A.).

February 4th.—"The Town Planning Proposals of the Urban Land Report." By Seebohm Rowntree (Hon.M.).

March 10th.—"Width and Allocation of Space in Roads." By F. Longstreth Thompson, B.SC.

April 14th.—"Horizontality and Verticality in the Architectural Treatment of Town Planning Schemes." By Barry Parker, F.R.I.B.A. (M.).

Waterproofing of Cement Roofs.—An open-air swimming bath has recently been constructed in Lister Park, Bradford. The cement flat roofs over the dressing-rooms have been made wet-repellent by the waterproofing powder Pudlo.

Coast Sand Dunes, Sand Spits, and Sand Wastes. (By G. O. Case. Price 5s. St. Bride's Press, Limited, 24 Bride-lane, E.C.). . . . "A most useful little book crammed with facts culled from all parts of the world and well illustrated with photographic reproductions and diagrams. Numerous references to other works are given. Mr. Case discusses the formation and distribution of sand dunes and the devastation caused by them when they move inland, and then goes on to consider protective works and the reclamation of sand wastes. If we have one criticism to offer it is that the book is too condensed. There is certainly not a superfluous paragraph."—*Geographical Journal.*

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

BUILDING AND SANITARY INSPECTOR.—September 20th.—Egham Urban District Council. £135 per annum.—Mr. A. G. Hutchins, clerk, 50 High-street, Egham.

SURVEYOR.—September 24th.—Enniskillen Urban District Council. £100 per annum.—The Clerk.

DISTRICT FOREMAN.—September 25th.—Deptford Borough Council. £2 per week.—Mr. A. Purkis, town clerk, Town Hall, New Cross-road, S.E.

ENGINEER AND SURVEYOR.—September 29th.—Conway Rural District Council. £2 10s. per week.—Mr. J. Porter, clerk.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

YORK. — November 30th.—Schemes under the Housing and Town Planning Act, 1909, in connection with certain areas within and without the city of York, for the corporation. Premiums, £100, £50 and £25.—Mr. F. W. Spurr, city engineer, Guildhall, York.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

SLEAFORD.—September 18th.—For repairs to two bridges, for the rural district council.—Mr. A. Parry, highway surveyor, Council Offices, Northgate, Sleaford.

GELLYGAER.—September 20th.—For the construction of an underground convenience, for the urban district council.—Mr. T. Rees Gabe, acting surveyor, Council Offices, Hengoed, Glam.

PLYMOUTH.—September 21st.—For alterations and repairs to certain premises, for the corporation.—Mr. J. Paton, borough engineer and surveyor.

RUNCORN.—September 21st.—For the extension of the cottage hospital, for the urban district council.—Mr. J. Wilding, surveyor.

SHEFFIELD.—September 21st.—For the construction of foundations for four new boilers, for the Electric Supply Committee.—Committee Offices, Commercial-street, Sheffield.

HUNTINGDON.—September 30th.—For the erection of forty workmen's houses, for the corporation.—Borough Surveyor, Hartford-road, Huntingdon.

TAMWORTH.—September 30th.—For the erection of twenty-four cottages, for the corporation.—Mr. A. Clarson, surveyor, 21 Church-street, Tamworth.

NEATH.—October 1st.—For the erection of an isolation hospital, for the Joint Hospital Committee.—Mr. J. C. Rees, architect, Parade Chambers, Neath.

Engineering: Iron and Steel.

NEWPORT (I.W.).—September 20th.—For the strengthening of a swing bridge, for the corporation.—Mr. E. A. Slater, borough engineer.

SELBY.—September 20th.—For the laying of cast-iron and wrought-iron pipes, for the rural district council.—Mr. R. F. Braithwaite, surveyor, 33 Finkle-street, Selby.

NEWMARKET.—September 20th.—For the supply of a 5-ton steam wagon, with a body for haulage, and an interchangeable water tank, for the urban district council.—Mr. W. H. Eley, engineer and surveyor, Town Hall.

RHONDDA.—September 21st.—For the supply of lead and compo. pipe, for the urban district council.—Mr. O. Thomas, engineer and manager, Gas and Water Offices, Pentre, Rhondda.

ACTON.—September 21st.—For the supply of a petrol motor fire engine pump, and a petrol motor escape, and also for alterations to fire station, for the urban district council.—Engineer and Surveyor.

CHESTERFIELD.—September 25th.—For laying 950 yds. of 7-in. cast-iron water mains, for the rural district council.—Mr. G. Frith, engineer, Council Offices.

WARRINGTON.—September 27th.—For the supply of a sectional boiler and heating pipes, for the Health Committee.—Borough Surveyor, Town Hall.

DUNDEE.—September 27th.—For the heating and ventilating of the city hall buildings, for the corporation.—Mr. J. Thomson, city architect, Municipal Offices, 91 Commercial-street, Dundee.

TODMORDEN.—For the resetting of retorts, for the Gas Committee.—Mr. F. V. Barnes, engineer and manager, Gasworks, Todmorden.

Roads.

CHORLEY.—September 20th.—For the supply of paving setts, kerbs, flags, broken granite and chippings, and limestone chippings, for the corporation.—Mr. G. H. Hopkinson, borough surveyor, Town Hall.

BEACONSFIELD.—September 21st.—For the supply of 700 tons of 1½-in. broken granite, for the urban district council.—Mr. J. Diggle, surveyor.

CAERPHILLY.—September 21st.—For road improvement work, for the urban district council.—The Surveyor, Council Offices.

WOODBRIDGE.—September 23rd.—For the supply of 200 tons of broken granite, for the urban district council.—Mr. W. Brooke, Council Offices.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. SEPTEMBER 24, 1915. No. 1,236.

Minutes of Proceedings.

Tramways in War Time.

The Municipal Tramways Association is holding its annual conference in London this week, but, like most other societies, has decided to forgo all festivities and social functions, the proceedings, therefore, are confined to technical discussions and the usual business meetings. The effect upon the working of the tramways of the abnormal conditions which have prevailed during the past year is naturally the subject which is uppermost in the minds of the members, and was to be discussed yesterday under the respective heads of labour and finance. As in the case of all other industries employing large numbers of men of military age—with the exception of the Civil Service, which has been carefully kept "under the umbrella"—the tramway service of the country has suffered from the abstraction of a large proportion of its personnel. From the Manchester Corporation tramways, for instance, over 2,000 men have gone to join the Colours, and it is estimated that in all over 18,000 tramway employees are on war service. Such heavy drafts at a time when labour is at a premium cannot readily be made good, and in many cases the employment of women as conductors has been found unavoidable necessary. The male employees, as might be expected, regard this step with a rather jaundiced eye, learn that it may produce a permanent effect upon their status in the future, and have insisted upon the maintenance of the full standard of wages. In some centres they have gone further, protesting against the employment of women and threatening to strike if the movement is persisted in. "Needs must, however (though we do not suggest that the devil drives the tramcars), and no fewer than 800 women now collect the fares on Glasgow tramways, while many other municipalities have adopted the same policy, though to a less extent. So far the innovation appears to have met with success beyond all expectations, and the movement is rapidly extending. Apparently the London area is not to share the privileges enjoyed by provincial towns, for the police authorities have declined to issue licences to women conductors on the lines of the North Metropolitan Tramways Company.

With regard to the effect of the war upon finance, in many cases wages have been increased and war bonuses ranging from 1s. to 3s. per week are being paid to the employees, while the allowances made to men who have enlisted and to their dependents have imposed a heavy burden upon the undertakings. Manchester, for instance, is paying at the rate of £70,000 a year under this head, and the London County Council expended over £42,000 during the year ended March 31st. War bonuses are costing Manchester £17,000 a year, and Leicester estimates the increased cost due to the war at £30,000 for the current year. The effect of the war upon traffic receipts has varied greatly according to local conditions. Holiday resorts have naturally suffered a marked decrease in receipts, but the tramways in industrial and military centres have thriven more than ordinarily. At Newcastle, for example, the receipts for the year increased by £32,000, and Glasgow reports that last week broke all local records, the receipts being £23,000. Manchester tramways were again able to contribute the handsome amount of £100,000 to the relief of the rates. The London County Council tramway receipts were higher than last year, but the increased expenses brought about a deficit of £33,000, which it is anticipated will increase to £91,000 in the current year; and as the disastrous strike involved a loss of £100,000, the deficit next year will wipe out the reserve fund, which has already been heavily drawn upon. The restrictions imposed by the Treasury upon municipal expenditure have led to the postponement of extensions in many places, including a London County Council scheme that would have cost £250,000. It will be seen that war conditions have given tramway managers plenty to think about, and are likely to produce effects which will be felt for many years to come.

* * *

Bursts in Cast-iron Mains.

When a large cast-iron water main bursts in the middle of a great town or city the inconvenience and damage to property, accompanied sometimes by loss of life, are such as to make the investigation of causes a matter of urgent importance. Although such accidents are comparatively rare, they do occur sufficiently often to make the subject one in which every water engineer is concerned. There have been many very serious instances, some of them occurring in London, within recent years. Mr. Hazen, in a paper read in America, mentioned some 72-in. mains laid in connection with the Croton aqueduct which failed, about 4 per cent of the pipes being broken. One has not far to look for instances. On the other hand, it does not appear that much attention is given to causes of failures in this country. In America, however, considerable attention has been

given to the matter, and investigations are made and results reported in a manner which might well be copied in this country. The failure of a 60-in. main at Cincinnati was carefully investigated, and the results were recently published in a New York engineering journal. These will be referred to later.

In cast-iron pipes there are internal stresses which are the result of the unequal cooling of the casting, and these may be increased by the vertical load on the top produced by the filling or by other outside agencies. Again, such stresses may be greatly increased if the main is badly supported on its foundation. At some point all these stresses may be cumulative, and the stresses due to unequal cooling of the metal, to the pipe having to act as a beam to unequal and insufficient support, to internal water pressure and water ram, and the stresses due to the weight of the filling material or to other loads on the top, may combine at a certain point and produce fracture. These facts are generally admitted, but there are other possible causes of failure, as may be seen from the report of the investigations at Cincinnati. In this case a serious burst occurred in a 60-in. main, owing to which three lives were lost. It was found that longitudinal stresses of large amount were produced in the pipes from the end contact of a number of adjoining pipes. It appears that the pipes were laid in such a manner that the spigots had a bearing on the sockets at one point only in each case.

Our American contemporary points out that it is easy to conceive of the enormous strains set up on a small area when the spigot end is in contact with the bell at one point only and the pressures are applied on the convex side of a slight curve. The tendency is to straighten out a flat arch ring in which the faces of the voussoirs bed at points only, resulting in enormous localised unit pressures. This possibility is too often overlooked, and it may be added that, in addition to the possibility of a vertical load, there are possibilities of side thrusts from various causes, and that the results of expansion should also be considered. Thus it becomes evident that some clearance between the spigot and socket is desirable, the space being filled with some material of a durable and compressible nature. Some engineers make a practice of allowing such a clearance and fill the space between the spigot end and the socket face with lead wool, cement, or other suitable material, working from the inside of the pipe. The experience at Cincinnati is not unusual, except for the fact that, the causes of failure having been investigated, the results were published for the instruction of water engineers. Similar reports of the failures of London mains during recent years would have been interesting reading, and might have prevented mistakes on work in this country and abroad.

* * *

A Highway Case.

It is a well recognised general rule of law that a highway authority is not liable in an action for damage resulting from the mere non-repair of a highway under their control. This doctrine received the sanction of the House of Lords as long ago as 1892 in the well-known case of *Cowley* v. *The Newmarket Local Board*, and it has not since been seriously challenged. In that case an owner of land adjoining the highway, in making an approach to his land, without the sanction or authority of the local board, made a drop in the level of the highway and left it in a dangerous condition. The appellant, walking along the highway, fell down the drop and was injured. He thereupon brought an action against the local board, alleging that they were guilty of non-feasance in that they had suffered the highway to be out of repair and in a dangerous condition. In these circumstances the House of Lords held, confirming the decisions of the Courts below, that no action lay against the board. Although, as we have said, this decision has not been questioned, a number of cases have arisen in which it has been difficult to say whether the acts alleged against the local authority did or did not amount to misfeasance. For example, in the case of *Irving* v. *The Carlisle Rural District Council*, the plaintiff alleged that his fields had been flooded and damaged by water overflowing from a ditch on one side of a highway which was under the control of the defendant council. The water entered the ditch from the road by means of grips which had been cut by the defendants, but the immediate cause of the damage was the omission to have the ditch sufficiently cleansed. It was held that the damage arose from mere non-feasance, and that the council were therefore free from liability. In the course of his judgment, Mr. Justice Darling dealt with the plaintiff's contention that the damage was due to misfeasance, in that it was caused by the doing of something—namely, the cutting of the grips—which allowed the water to flow from the road into the ditch. He then went on to express the opinion that this did not amount to the doing of an act in the sense that it was that which injured the plaintiff, and not simply the failure to clear out the ditch. From this it would appear that to found an action for damages on misfeasance the act relied upon must be the *causa sine quâ non*, and not merely the *causa causens* of the injury.

A rather similar case was before the Courts recently—*Masters* v. *The Hampshire County Council*—in which the rule laid down in Irving's case was applied. In this case the plaintiff sustained injuries by falling into a grip which had been cut by the defendant council at the side of a highway for the purpose of facilitating the flow of water from the surface of the highway into ditches. The immediate cause of the accident appears to have been the failure on the part of the defendants to keep the grip free from growing grass. In these circumstances the learned judge said that if a highway authority, in the course of making a highway, does something out of the reasonable course in so making the highway, and makes it improperly, that would be a case of misfeasance. But if all that has been done by the highway authority is to make the grip and leave the road alone, that is non-feasance, and they are not liable. The normal way or method of draining high roads is by cutting grips in the waste grass that lies on one side or other or on both sides of the road, and if grass grows in these grips the mere allowing it to do so is non-feasance and not misfeasance. This is the latest judicial pronouncement on a difficult point of highway law, and so is worthy of note, although it merely applies the doctrine laid down in earlier cases.

* * *

An Address to Students.

An admirable address on the subject of public water supplies was delivered some time ago by Mr. Percy Griffith, M.Inst.C.E., before the Birmingham University Engineering Society. So clearly did Mr. Griffith deal with the topic from the point of view of the engineering student, that we particularly desire to recommend our younger readers to study carefully the full extracts from the lecture which will be found in another column. Dealing first with the natural provision of water by means of rain, Mr. Griffith proceeded to point out in simple terms the main problems associated with the collection of the supplies required to provide for the needs of towns, villages, and rural districts, speaking in turn of gravitation supplies from upland gathering grounds, and surface and underground supplies requiring to be pumped. In regard to the former, the first problem to be solved is the adjustment of the available supply

[illegible] and the capacity of the impounding reservoir to the daily demand. This in itself [illegible] and shall not only [illegible] by the minimum variation in the daily consumption per head of the population in different towns, and the possibility of [illegible] [illegible] to the increase in consumption [illegible] the anticipated increase of the population [illegible] period of years. The selection of a site for the impounding reservoir is another preliminary question which requires great experience and judgment, as it is recognised that the cost and efficiency of the whole scheme will depend very largely upon the relative suitability of the site selected, and a mistake at this stage may involve a vast increase in the cost of the works and even the risk of ultimate failure. The next point to be considered is the choice of a position for the dam and the design of that structure. Mr. Griffith briefly described the construction of the two recognised types of dam—namely, the embankment of earth with a core of puddled clay, and the masonry dam—and uttered a word of warning in regard to the many terrible disasters that have occurred owing to faulty design of the weakest in the case of earthen embankments.

As regards surface and underground supplies, the lecturer emphasised the fact that the water engineer must [illegible] [illegible] acquaintance with the science of geology in order that he may be able in the first place to identify the surface conditions at the outcrop of the water-bearing strata, and also that he may trace what Mr. Griffith aptly described as "the progress of the precious element in its adventurous career underground." Underground waterworks may be classified as shallow wells for tapping subsoil water, deep wells for tapping deep-seated reservoirs, wells with artesian borings to tap deep-seated streams and borings (either with or without chambers or wells to take the pumps), and each of these classes was considered in turn, the principal difficulties of the work being pointed out. The final section of the lecture was devoted to the consideration of questions connected with pumping and pumping machinery. It will be seen that Mr. Griffith covered such a wide field that in the course of a single lecture it was not possible for him to deal in detail with the several matters discussed. For the student, however, the lecture was highly suggestive and well calculated to stimulate further research and study, and thus the primary object of the lecturer was achieved.

* * *

Smoke Abatement.

The smoke nuisance and its prevention were recently subjects of debate in the Chemistry Section of the British Association, and Mr. E. D. Simon, the chairman of the Manchester Smoke Abatement League, in the course of his speech remarked that domestic smoke undoubtedly provided at present the main field for such work. There was a possibility, he said, of the production, at a commercial price, of semi-coked coal which would burn as cheerfully as coal and as smokelessly as coke. Improvements were needed in the adaptation of open fires for the burning of coke, and, most important of all, in gas fires. Although valuable work was being done in Leeds, London, and Birmingham, much remained to be done to give the public a gas fire which would give out radiant and convected heat in the best proportions, would allow no leakage of gas into the air, and would give the right amount of draught up the chimney.

It is, however, at securing this very combination of advantages that engineers have been labouring during the last twenty-five years, and the success of their efforts was pointed out before the same section of the British Association by Mr. H. James Yates, F.C.S., M.I.MECH.E., who described as below the results of efforts to produce a gas fire which should give ample and controllable chimney ventilation and at the same time fulfil all the other modern scientific requirements: "The fire thus produced, in addition to its embodying the various points of design and construction called for by modern practice, has the further feature, distinctive to itself, of embracing a special contrivance, simple in appearance, but for long most baffling in the course of its evolution, by which, in injector fashion, a very large amount of air is removed from the room. Briefly described, this contrivance provides two outlets to the chimney. The conformation of these and of the adjacent parts is so proportioned, as the result of much experimental work, that by the under outlet the entire combustion-products are carried off, while by the upper or ventilating outlet a large volume of ventilating air is removed, the volume being controllable by a ventilation regulator." It will thus be seen that the modern gas fire approaches perfection as nearly as is possible, and that it should be a potent weapon in the Smoke Abatement Campaign.

* * *

The Chancellor and the Road Board Fund.

In the course of his Budget statement in the House of Commons on Tuesday, Mr. McKenna said that the proceeds of the increased tax on motor spirit will, for the time being, be retained in the Exchequer, and not paid to the Road Improvement Fund, and he added: "I hope the whole of the tax will be retained for the Exchequer during the war, but that is a subject with which it would not be proper for me to deal now." If these significant words are taken in conjunction with the recommendations of the Committee on Retrenchment in Public Expenditure, it would be fair to assume that the Chancellor of the Exchequer's hope will before long be fulfilled in actuality. The proposals of the committee include the suspension of the activities of the Road Board during the war, and an inquiry into the possibility of reducing the heavy expenditure of local authorities on highway maintenance by amendments of the law relating to the speed or types of heavy motor traffic. It is to be trusted that these suggestions will receive very careful consideration ere they are adopted, for it is obvious that a policy of prolonged parsimony in road maintenance can only result in accentuating the present difficulties of transit, while also causing serious financial trouble in the future. It is to be presumed that, though the motor spirit taxation may be diverted into the coffers of the Exchequer, the balance which the Road Board at present possesses will still be retained by that authority for the necessary purpose of road improvement, if only in a limited form.

Economies at Cheltenham.—The borough surveyor of Cheltenham, Mr. J. S. Pickering, submitted recently a report on the economies it was proposed to effect on account of the war. Alderman Waghorne said he had seen the report, and the savings in the course of being effected by the surveyor were considerable. Mr. Pickering informed them that sixty-six workmen, apart from officials, had joined the Army, and few of military age now remained. Most of the vacancies had been filled by men ineligible for the Army and by transfers from other departments. In order to effect still further economies, departments, where possible, were working with a decreased staff. The thanks of the council were due to those who were working under them in these critical times and were endeavouring as much as possible to keep down their expenses. Alderman Bendall, chairman of the Street and Highway Committee, thanked Mr. Pickering for the able manner in which he had handled matters in connection with his department with the object of saving the rates.

The Experimental Determination of the Effect of Varying the Percentage of Water in Concrete.*

By R. K. SKELTON.

The recent development of rapid mixers and chuting devices for placing concrete has resulted in the general use of exceedingly wet mixtures. A more or less sloppy consistency of the material is necessary for their successful operation, and as their use greatly lessens the cost of construction, the contractor naturally regards them with favour. On the other hand, the engineer has given the matter little thought or attention. He has allowed the contractors and manufacturers—both interested parties—to bring into use a mixture which meets their requirements, but is of questionable desirability. A little over a year ago such an eminent authority as Mr. McCullum protested against this practice, and even went so far as to suggest that the use of an excess of water was responsible for the failure of many concrete structures. Recently the same authority backed his claim with data obtained from practice. Experience has shown that a 1:2:4 concrete may be expected to develop from 1,800 lb. to 2,100 lb. per square inch. Samples taken from the floor of a building erected in Chicago within the past year in which the chuting system was used averaged 1,491 lb. per square inch. The strongest of the six failed at 1,650 lb. per square inch, and the weakest at 1,230 lb. per square inch. Mr. McCullum even ventures so far as to state that "proportions are of less moment than the mix."

If such is the case, the engineer has been very negligent in giving the question of mixing its due weight. In specifications the proportions are clearly and definitely stated, but the order in which the material shall be placed in the mixer and the amount of water to be used are given only passing attention, and in the field are generally slighted. A search through engineering literature has revealed the fact that research along these lines has not been very extensive or satisfactory. Most investigators have confined their attention to three mixtures—namely, dry, medium, and wet. Some, in publishing their results, have attempted to describe these mixtures; others have definitely stated the amount of water used, but have neglected to state whether or not this included the water required to moisten the sand and stone.

Last year, at the Masonry Materials Laboratory of the Sheffield Scientific School, Mr. Robison, under the direction of Prof. Barney, and with the assistance of Messrs. Lewis and Sherman, undertook a study of the effect of varying the percentage of water upon concrete. Mr. Robison used a 1:2:4 mixture throughout all the tests. All materials were mixed dry, and the amount of water, exclusive of that required to moisten the sand and stone, was varied from 20 to 42·5 per cent of the weight of cement. Four 6-in. cubes and four beams, 2 in. by 3½ in. by 3 ft., reinforced with two ½-in. round rods designed to carry 474 lb.,

TABLE I.

Mixture.	Stone.	Sand.	Cement.	Water.
Per cent.	lb.	lb.	lb.	lb.
20	120·7	56·5	35·1	15·2
22·5	120·7	56·5	35·1	16·0
25	120·2	59·1	36·7	17·7
27·5	131·6	61·7	38·3	19·4
30	131·6	61·7	38·3	20·4
32·5	131·6	61·7	38·3	21·4
35	131·6	61·7	38·3	22·3
37·5	131·6	61·7	38·3	24·3
42·5	131·6	61·7	38·3	25·3

placed at the centre, were made of each bath. The cubes were broken at the end of seven, thirty, and sixty days, the beams at the end of thirty and sixty. Mortar briquettes containing 20 oz. of sand and 12 oz. of cement were also made, and broken at the end of seven, thirty, and sixty days.

The details of the experiment are as follows: The amount of water necessary to moisten the sand was determined by thoroughly drying a given amount, weighing it, flushing it with water, draining off the excess, and again weighing it. The difference between the first and last weights was considered to be the amount of water absorbed. Several trials were made, and it was found that the sand took up water to the extent of 10 per cent of its weight. In a similar manner it was determined that the stone absorbed water to the amount of 2·1 per cent of its weight. In performing the above tests it was observed that the sand weighed 80·5 lb. per cubic foot, and the dry stone 85·9 lb. per cubic foot. The proportions of 1:2:4 by volume were then changed to 1:1·61:3·44 by weight. The actual weights used in the various tests were as given in Table I.

The water in each represented 2·1 per cent of the weight of the stone plus 10 per cent of the weight of the sand, plus the percentage of the cement by weight as indicated. The sand and cement were mixed until they were of uniform colour. The stone was then added, and the entire mass thoroughly mixed. The water was then added, and the mixing continued. The concrete was tamped moderately in placing. The forms were removed from the cubes at the end of twenty-four hours, and from the beams at the end of forty-eight hours. All specimens were kept wet for ten days and then stored in air. At the same time a corresponding series of briquettes were made according to Table II.

TABLE II.

Mixture.	Sand.	Cement	Water.
Per cent.	oz.	oz.	oz.
20	20	12	4·1
22·5	20	12	4·7
25	20	12	5·0
27·5	20	12	5·3
30	20	12	5·6
32·5	20	12	5·9
35	20	12	6·2
37·5	20	12	6·5
42·5	20	12	Too wet to make.

The water necessary to moisten the sand is included in the gauging water. This was figured in a manner similar to that used in the case of the concrete for the beams and cubes. The briquettes were stored one day in the damp closet and the remainder of the time in water as is customary.

The beams and cubes were tested in an Olsen compression machine of 200,000 lb. capacity. As the specimens were made in wooden forms they were carefully measured before crushing. Table III. shows the results of the compression tests of the cubes.

In this table and Fig. 1 the wide range of the strength of the various mixtures is very noticeable. This must be due entirely to the variation of the gauging water, for particular care was taken to keep all other factors the same.

TABLE III.

Mixture.	Seven days.		Thirty days.		Sixty days.	
	Lb. per sq. in.	Relative strength	Lb. per sq. in.	Relative strength	Lb. per sq. in.	Relative strength.
Per cent.						
20	2052	0·82	2777	0·80	3194	0·89
22·5	2173	0·87	3132	0·90	3305	0·92
25	2277	0·91	3277	0·94	3388	0·94
27·5	2500	1·00	3486	1·00	3597	1·00
30	1722	0·69	2875	0·82	3166	0·88
32·5	1413	0·56	2416	0·69	2666	0·74
35	1232	0·49	1977	0·57	2488	0·66
37·5	1097	0·44	1819	0·52	2173	0·60
42·5	652	0·26	1500	0·43	1888	0·52

Seven-day tests—One specimen.
Thirty-day tests—Average of two specimens.
Sixty-day tests—One specimen.

Considering only the question of strength, the 27·5 per cent mixture appeared to be the most desirable. In breaking the cubes a drier mixture than this was noticeably weaker, and a slight increase in the amount of water resulted in a decided decrease in strength. The 20 per cent cube was at the end of seven days eight-tenths as strong as the 27·5 per cent cube, and at the end of sixty days nine-tenths. On the other hand, the extremely wet mixtures did not test nearly so well. At the end of seven days the

* Paper read before the Connecticut Society of Civil Engineers.

...ality made from the 42·5 per cent mixture, which is of about the same consistency as is in use in practice of ramming a ...was approximately one-quarter as strong as that made from the 27·5 per cent mixture. At the end of ninety days the difference was not so marked, and at the sixty-day tests the 42·5 per cent mixture had increased 190 per cent in strength, while the 27·5 per cent mixture had increased but 44 per cent, thus making the latter about twice as strong as the former instead of four times, as was the case at the end of seven days. However, the 42·5 per cent mixture at this stage was not quite so strong as the 20 per cent mixture at seven days. Fig. 2 shows graphically the relative strength of the different mixtures. The strongest mixture (in each case the 27·5 per cent) was taken as unity, and the strength of the other specimens was expressed as percentages of the strongest. The effect of ageing is shown very clearly in the flattening of the curve. This can be partially explained by the fact that the

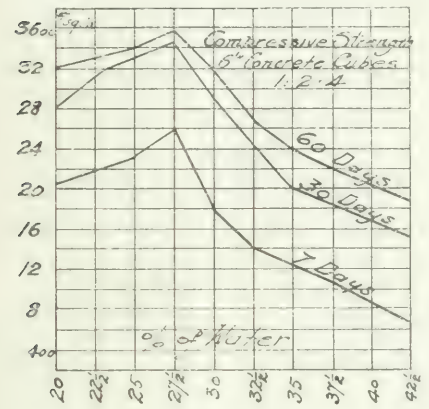

FIG. 1.

...equation, slight differences in manipulation or in storing becoming of less consequence. But undoubtedly the greater part of gain in the strength noticed in the wet mixtures was due to the drying out of the excess of water. Although we have no data upon which to base definite conclusions, it seems reasonable to expect a further flattening of the curve, but it hardly seems possible that it would ever become a straight line. This would mean that the mixtures had all attained the same strength. Inasmuch as the forms are removed within a comparatively short time after pouring, and the concrete subjected to heavy loads while green, the curves showing the relative strength at seven and thirty days are of more interest to the practical engineer than those representing the strength developed in a long period covering several months.

The results of the tests of the beams are given in Table IV. and the accompanying chart.

TABLE IV
Transverse Test of Beams.

Mixture.	Thirty days.		Sixty days.	
	Lb. per sq. in.	Relative strength.	Lb. per sq. in.	Relative strength.
Per cent.				
20	290*	0·46	500	0·44
22·5	368†	0·58	410	0·60
25	472	0·74	570	0·81
27·5	647	1·00	680	1·00
30	507	0·80	560	0·82
32·5	457	0·72	500	0·74
35	417	0·65	450	0·66
37·5	360	0·56	400	0·59
42·5	313	0·49	340	0·50

Thirty-day tests—Average of three specimens.
Sixty-day tests—One specimen.
*One beam broken by premature removal from mould.
†Two beams broken by premature removal from moulds.

All specimens carried the load for which they were designed, but the extremely wet, and especially the extremely dry, had a very small factor of safety. As in the cube tests the 27·5 per cent mixture proved the strongest both at the end of thirty and sixty days. The relative strength of the beams made of concrete with from 27·5 per cent to 42·5 per cent water was practically the same as of the cubes of the same consistency. The drier mixtures did not show up so well when cast into beams. For example, the 20 per cent mixture, when subjected to compressive stresses, was eight-tenths as strong as the 27·5 per cent mixture at the end of thirty days and nine-tenths as strong at sixty, but when tested as a beam was somewhat less than half as strong in both cases. In the cubes the wet mixtures were extremely weak, but in the beams the dry mixtures were a trifle weaker than the wet ones. This may be due to the fact that a beam exposes more surface to the atmosphere per unit volume than the cube. In this case the former exposed about 24 sq. ft. per cubic foot, and the latter about 10 sq. ft. Undoubtedly this had some bearing upon the results.

The tensile strengths of the various mixtures are given in Table V.

TABLE V.
Tensile Strength of Briquettes.

Mixture.	Seven days.		Thirty days.		Sixty days.	
	Lb. per sq. in.	Relative strength.	Lb. per sq. in.	Relative strength.	Lb. per sq. in.	Relative strength.
Per cent.						
20	212	0·70	353	0·84	450	0·80
22·5	293	0·98	412	0·98	505	0·90
25	300	1·00	418	1·00	565	1·00
27·5	280	0·93	397	0·95	537	0·95
30	240	0·77	356	0·85	425	0·76
32·5	170	0·57	227	0·54	305	0·54
35	141	0·47	193	0·46	275	0·49
37·5	137	0·46	173	0·41	220	0·39
42·5	Too wet to make.					

Seven-day tests - One specimen.
Thirty-day tests—Average of three specimens.
Sixty-day tests—Average of two specimens.

...results vary thus obtained on the other ... the mixture giving the maximum strength

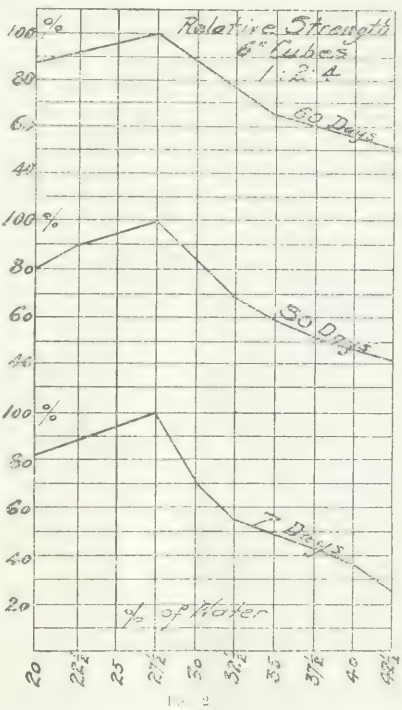

FIG. 2

was a trifle drier, containing 25 per cent water against 27·5 per cent for the tests of the beams and cubes; but the general relation of consistency to strength was the same. The wet mixtures seemingly developed their tensile strength faster and therefore showed up better, especially at seven days. The increase in strength of the different mixtures was more uniform, and for this reason the relative strength was practically constant regardless of age.

These tests have demonstrated that the percentage

of water has a direct bearing upon strength. Nevertheless, it is the exception rather than the rule that the engineer concerns himself with the question of mixing beyond seeing that the proper proportions of sand, stone and cement are used. Careful tests are made of the cement and steel, both standard articles put out by firms that have a reputation to

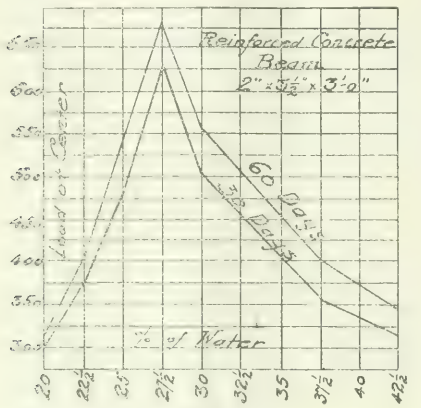

Fig. 3.

maintain. On rare occasions the water is analysed. But no attempt is made to control the mixing. On some pieces of work the contractor is furnished with the cement so that there will be no temptation to skimp on materials. He is then given the liberty to mix these materials as he sees fit. He may aim to get the maximum strength out of them, but chances are that he will strive rather to keep the cost of mixing and placing at a minimum. Mr. McCullum, [illegible] Engineering News of December 12, 1913, suggests that the contractor be made to guarantee his concrete to withstand 2,000 lb. per square inch in compression at the end of a month, and would provide that test pieces be cast from the actual concrete used, the acceptance be based upon the

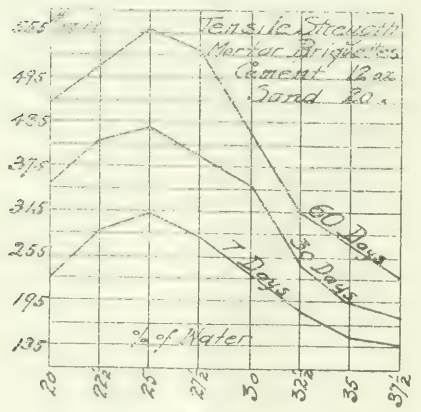

Fig. 4.

[illegible] The [illegible] somewhat drastic. The engineer should assume a part of the responsibility. In his preliminary work he should not only consider the question of the proportions of cement, sand and stone, but should determine the most desirable consistency. He should state this consistency and the details of mixing in clear, definite and concise terms in his specifications. Then if the contractor adds more water or shortens the time of mixing, he does so on his own responsibility.

Of course, it must be admitted that the strongest mixture is not always the most desirable or economical. In preparing the specimens for these tests it was found necessary when making mixtures containing more than 27·5 per cent to increase the proportions 10 per cent in order to fill the moulds. This indicates an increase in density which was obtained at a loss of strength. However, in some cases this is highly desirable. Often bulk and impermeability are the two requisite features. In reinforced concrete structures a moderately wet mixture is far more practical than a dry one. But it must not be forgotten that the use of wet mixtures increases the cost of materials. An increase in density means a corresponding increase in raw materials. The additional water weakens the concrete, and therefore a richer mixture or lower unit stresses must be used. The former is preferable, for the beams and columns in concrete buildings are always heavier than the corresponding members of steel or wooden structures.

If a wet mixture is used the engineer should be cautious in permitting the removal of the forms at an early date. It will be recalled that in some of the tests the wet mixtures were very slow to develop their strength. The use of such consistencies in practice would necessitate extreme care. It might be a month or more before the forms could be struck with any feeling of security.

The question of consistency is not altogether a laboratory question. The increased cost of materials due to the use of wet mixtures may be more than offset by the saving in placing. But the engineer should bear in mind that consistency has a direct relation to strength, and if he permits a wet mixture should provide for the same in his design. In any event he should control the details of the mixing.

RETRENCHMENT IN PUBLIC DEPARTMENTS.

PROPOSED SUSPENSION OF THE ROAD BOARD.

The Government on Tuesday night issued as a White Paper the first report of the Committee on Retrenchment in the Public Expenditure, of which the Chancellor of the Exchequer is chairman. The committee is continuing its deliberations, but makes in this report suggestions which it thinks may be put into force at once.

The reference to the committee was to inquire and report what savings in public expenditure, in view of the necessities created by the war, can be effected in the civil departments without detriment to the interests of the State. Thirteen meetings have been held, and evidence has been taken from a number of the larger departments, and from representatives of the London County Council.

The main points in the report are as under:

The suspension of the Road Board is recommended, the taxes earmarked for its service to be retained by the Exchequer.

The Board of Education, Local Government Board and Board of Agriculture have asked local authorities to economise on all services not absolutely necessary.

The committee recommend that no vacancies arising in public departments should be filled pending their final report, except where it would be to the serious detriment of the public service to leave them unfilled.

The Office of Works has undertaken to save £500,000 on the estimates for new buildings for Government departments.

With regard to the Road Board the committee heard the evidence of Sir George Gibb, chairman of the board, and the report states:—

"The committee was informed that the income of the fund was approximately £1,500,000 per annum, and that the board had not in any year since it came into existence spent the full amount of its income (indeed, during the present year, owing to special war restrictions, the grants were not estimated to exceed £300,000), with the result that, after allowing for all outstanding liabilities, there would be an estimated surplus of £3,000,000 on the fund at the close of the present financial year.

"The committee fully recognise the importance of the duties entrusted to the Road Board, and the great ability and efficiency with which they have been performed; but in view of the altered position of the public finances and the urgent necessity of utilising all available resources of revenue for meeting the charges resulting from the war, they feel bound to recommend that the activities of the Road Board should be suspended during the war, and that the proceeds of the taxes earmarked for the service of the board should be retained in the Exchequer."

The committee also recommend that an inquiry be held into the possibility of reducing the present heavy expenditure of local authorities on highway maintenance by amendments of the law restricting the speed or types of heavy motor traffic.

Public Water Supplies.*

By PERCY GRIFFITH, M.INST.C.E., F.G.S., F.R.S.A.I.

A comprehensive study of this subject will bring you into contact with almost every branch of science, will involve the investigation of almost every known law of Nature, and will necessitate the study of many social and economic laws. Hence the prospective water engineer must commence by careful study of the mechanical and physical sciences; he must miss no opportunity of observing the fundamental laws of Nature; he must acquire a practical knowledge of social and commercial principles, and, to secure prominence in the profession, must collect, absorb and apply information of all kinds from all sources with intelligent enthusiasm and untiring assiduity.

The subject of waterworks naturally divides itself broadly into two parts—(1) gravitation supplies from upland gathering grounds, and (2) surface and underground supplies requiring to be pumped. I will deal with these in turn. Meanwhile I must point out that, as Nature but rarely provides pure water under conditions which dispense with the intervention of the water engineer, this profession is one of the most ancient known to man, and works executed hundreds of years ago prove the substantial manner in which the early water engineers designed and carried out their works. These works were all of the "gravitation" class, as pumping machinery was at that time unknown except on a small scale, and in the form of elementary elevators worked by manual or animal powers.

GRAVITATION SUPPLIES FROM UPLAND GATHERING GROUNDS.

Although this class of works is the simplest, it must not be assumed that schemes of this character can be designed and carried out without considerable study and experience. In the first place they are proportionately far more costly than pumping [illegible] consequences of a far more serious character, and the calculation of the available supply of water and the capacity of the reservoir, the selection of a suitable site for the embankment or dam, and finally the design and execution of the works themselves, involve difficulties which can be overcome only by the most elaborate investigation and careful study, and after many years' practical experience in subordinate capacities, under engineers in active practice.

I will now briefly deal with these points in the sequence stated.

Calculation of the Available Supply of Water and the Capacity of Reservoir Required.—This matter is one involving some very interesting investigations, but it is first necessary to grasp the real purpose to be secured by the impounding reservoir—viz., the adjustment of the available supply to the demand. Now the daily demand in any given town varies considerably during the year, more so in purely residential areas than in those with manufactories or works using water for trade or manufacturing purposes. This variation is, however, more conveniently provided for by service reservoirs constructed either on adjacent high ground, or on towers in cases where no hills are available. As regards impounding reservoirs, therefore, we may assume the daily demand to be constant throughout the year, and may start by an assumed average daily demand to be provided for by the intended works. This figure must, of course, be large enough to provide for the anticipated increase during a period of years, as works of this character are too costly to be enlarged or duplicated at short intervals, as may be done with pumping schemes.

Having arrived at the daily quantity to be provided at the reservoir outlet it remains to be determined what capacity of reservoir is necessary to secure such a supply from a constantly varying inflow from rainfall. The most certain method of doing this is by gauging the flow of the stream draining the watershed at a point corresponding to the site of the dam.

A difficulty arises in gauging the flow when there is a wide difference between the maximum and minimum flow, because when the stream of water flowing over the notch is less than 3 in. or more than 2 ft. the formula from which the rate of flow is obtained becomes inapplicable. In streams liable to heavy floods, therefore, the weir should be provided with movable sides, or it may be stepped along its length. It is important to provide a large and deep reservoir on the upstream side of the weir to prevent the water from approaching the notch with any considerable surface velocity; the water must have a clear fall below the notch to allow free access of air to the underside of the discharging stream, and the depth of the stream passing over the notch—which is the coefficient from which the flow of water is calculated—must be measured at a point some distance back from the notch, where the water is without appreciable movement. Various formulæ are available for calculating the flow from the depth of water passing over the sill, but they are too complicated to be explained in this short lecture.

It is, however, rarely possible to obtain sufficient records of the flow of streams to enable a reliable estimate to be made of the average maximum and minimum supply available, from which the capacity of the reservoir and of the overflow channel are calculated. Daily records over a long period of years would alone give reliable data, and it is usual, therefore, to utilise rainfall records. If such records are not available for any particular watershed, it is possible, by comparing local gaugings taken over a comparatively short period with gaugings in similar watersheds where longer records are available, to deduce a fairly accurate estimate of the essential figures—that is to say, the average rainfall of three consecutive dry years, which is usually accepted as the basis for calculating the storage necessary in any given case.

In this country the amount of storage required—expressed in terms of $\frac{\text{Total storage}}{\text{Daily demand}}$—varies from 120 days to 250 days, but in tropical countries like India it may be necessary to impound a quantity representing the total demand of a period extending to two years or more than 700 days.

In these calculations due allowance must be made for losses by evaporation and percolation. The former may in this country amount to from 12 in. to 27 in., calculated over the whole watershed or gathering ground, and varying according to the slope of the surface and the nature of the vegetation and subsoil. Loss by percolation should be prevented by carrying the watertight core of the dam down to solid rock throughout its length.

I must here say a few words as to the method of arriving at the average daily demand, which is the main factor in the calculations for storage capacity. This is usually expressed in terms of gallons per head of the population, but when it is realised that the supply to be provided must include water required for trade manufacturing and other non-domestic purposes, it will be seen that no standard rate per head can be accepted as common to all cases. For purely residential districts the rate may vary from 15 to 20 gallons per head, but in industrial areas it may rise as high as 50 gallons per head, and in many American and Continental cities the consumption reaches 120 to 150 gallons per head of population. In London the average consumption is 36 gallons per head, and this may be considered as a very liberal allowance for any area, including both residential and industrial properties, while for rural areas without any appreciable trade demand a supply of 15 gallons per head is ample.

Selection of Site for Impounding Reservoir.—This is a problem requiring experience and judgment for its solution, because the cost and efficiency of the scheme will depend very largely upon the relative suitability of the site selected, and a mistake at this stage may involve a vast increase in the cost of the works, and even the risk of ultimate failure. If you are familiar with the mountains of Wales or Cumberland, you will realise at once that the configuration of the smaller valleys affords everything necessary to the formation of an impounding reservoir except a wall or bank across a valley. The main question is therefore where a watertight bank or wall can be most effectively and economically constructed. The most important points for investigation are (1) the impermeability of the area to be covered by water, and (2) the possibility of constructing the dam so as to intercept the whole of the available yield of the gathering ground; in other words, Nature must provide a watertight basin, or [illegible]

* From a lecture delivered before the Birmingham University Engineering Society.

is useless to endeavour to collect water in it. Fortunately these mountainous areas are usually formed of the older and deeper rocks which are for the most part impervious, but which are generally much "faulted" and fissured. Having ascertained by careful examination that the area of the intended reservoir is generally impervious, it is necessary to determine at what depth a homogeneous and impermeable rock will be found in which the base of the dam can be effectively sealed. This information is obtained by sinking trial holes (or wells), and borings at various points along and across the valley.

Suitable conditions having been found to exist, a contour-survey of the valley immediately above the site or sites suggested for the dam must be made, in order to estimate the height of dam required to impound the quantity of water previously determined.

At this stage consideration must also be given to other questions, such as the proximity of materials suitable for the construction of the dam, the existence of roads intersecting the area to be covered by the reservoir, the liability of the gathering ground to pollution, &c., and with this information it will be possible definitely to select the most suitable site for the dam, and, this being settled, to proceed with the design of the works.

Design and Execution of the Works.—In "gravitation" schemes the works comprise many important items besides the embankment or dam, as, for example, a by-wash channel for diverting the stream from the reservoir in times of flood or during repairs, an overflow channel for releasing surplus water without injury to the dam, an outlet tunnel with pipes and valves for controlling the amount drawn from the reservoir, apparatus for regulating and measuring the quantity of "compensation" water, apparatus for filtering the water supplied to the town, the pipe line or conduit conveying the water to the town, &c., but in this short lecture I cannot do more than briefly refer to the construction of the embankment or dam and the works immediately connected with it.

There are (as no doubt you know) two types of dams, the embankment of earth with a core of puddled clay and the masonry dam. The former is by far the more common, although not by any means the more picturesque, and for moderate heights it may be looked upon as perfectly satisfactory and as more generally applicable than a masonry dam. A trench is first of all cut across the valley, extending to the solid rock, and the materials excavated from the trench must be distributed over the area representing the base of the embankment, as it is important that this large quantity of material should not have to be moved twice. The portion of the bank immediately adjacent to the puddle core must, however, be formed of specially selected material, and it is the special function of the engineer so to organise the work as it proceeds that a sound and efficient result may be obtained at a minimum of cost. You will observe that during the digging and filling of the trench the water flowing in the stream must be carried over the excavation by a temporary bridge, and it is important to see that this is constructed of sufficient capacity to carry the maximum flood which may occur during the period in question, otherwise the trench may be flooded and much loss of time and money result.

The trench being completed, and a portion of the bank proportionate to the depth and width of the trench formed, the next step is the filling of the trench with either clay puddle or concrete. Engineers differ as to which is preferable, assuming both are equally available, but there is probably less skill required, both in the work itself and in its supervision, if puddle is used. At the same time concrete will be more generally available than clay, and the engineer must make a special study of the precautions necessary to secure watertight concrete, as this material is constantly required in the construction of waterworks. Having completed the filling of the trench, the bank and puddle core are then proceeded with. The work must be carried up as uniformly as possible throughout its length, the bank being formed in layers of about 3 ft. thickness, each well consolidated before the next layer is added.

Through the lower portion of the bank is constructed the outlet tunnel, which is usually placed as nearly as possible adjacent to the original bed of the stream, in order to drain the lowest part of the reservoir. This tunnel will ultimately be provided with the outlet and wash-out pipes, and on the completion of the dam will be bricked up for a length of from 10 ft. to 20 ft., so as to prevent water escaping through it.

The design and construction of the overflow is particularly important in the case of earthen embankments, because should the overflow be insufficient to carry away flood water, and the reservoir begin to overflow on to the earthwork, this would be rapidly washed away, and the whole structure be in danger of collapse. Many terrible disasters have occurred from this cause, and it is therefore desirable to make very liberal estimates in calculating the maximum quantity of water to be provided for in the overflow and channel leading from it. In some cases the overflow and its channel have been constructed in the adjacent hillside, so that these works are quite independent of the embankment; but, of course, this is a more costly method than the more usual practice of constructing the overflow at one end of the bank and carrying the channel down the angle formed by the bank and the hillside. The overflow and channel must, for obvious reasons, be constructed in masonry or concrete.

In a masonry dam the base of the dam must rest throughout its length and breadth on solid rock, and unless this can be formed comparatively near the surface, the cost of the work is likely to be prohibitive. The profile of the dam affords some scope for variety, and practice reveals many alternative types; but the calculations for stability are more or less identical with those involved in retaining walls. It is accepted as a maxim that the stresses forming the resultant of the water pressure and the weight of the structure should fall within the middle third of the section. Masonry dams, besides being more suitable for deeper reservoirs, offer the further advantage that, at but little extra cost, they may be so designed as to permit of their being raised should further storage be required at a subsequent date.

(To be concluded.)

WATER DIVINING.

A PUZZLED COUNCIL SURVEYOR.

Colonel Farquhar Glennie and the Rev. J. S. Leake were engaged last week, states the *Daily Graphic*, in conducting water-divining experiments on Blackdown, near Haslemere, at the request of the Haslemere Urban District Council, who are seeking guidance as to the direction in which extensions of the water headings of their undertaking should take place.

The water-diviners are both local gentlemen, and were accompanied on their quest by Mr. H. V. Snook (the surveyor of the council) and the chairman, Mr. George Whitfield. Prior to the experiments the latter were admittedly sceptical as to the virtue of water-divining with the hazel twig, but both have since confessed that their scepticism has been rudely shaken.

"It was uncanny," remarked the surveyor in an interview. "I had previously gone thoroughly into the question of the geological sub-strata at Blackdown, and had come to the conclusion that water-bearing fissures ran in certain directions in consequence of the dip of the clay. The diviners knew nothing about this, yet their conclusions as to the fissures absolutely coincided with the geological conclusions. I had also marked a tree with an arrow to identify the existence of headings, and the hazel twigs led the diviners to this also."

The council have decided to adopt the course suggested for the extension of the headings, the result from the water-divining and from the geological examination being the same—that there are still large sources of water untapped on Blackdown.

Working-class Housing in Devon.—In his report for the year ended March 31st last Dr. Nelson Wood-Hill, medical officer of health to the corporation of Tiverton, mentions that the first part of the council's housing scheme has been completed by the erection of eighteen houses on a pleasant and well-drained site in Chapel-street. The houses have been fully occupied since their completion, and have been much appreciated by the tenants. Each house has a good garden, a bath, a separate water-closet and yard. Fourteen of the houses have a large living-room and scullery downstairs, and three bedrooms, while four have in addition a parlour and hall entrance, and for this type there is sharp competition when a vacancy occurs. Dr. Wood-Hill congratulates the council on the success of this first stage in their endeavour.

Temporary Buildings for Military Purposes.

1.—TIMBERS.

By G. BERTRAM HARTFREE, F.S.I., Surveyor to the Alton, Hants, Urban District Council.

Speedy erection and low initial cost being of importance in the construction of huts, wood is generally used for carcase work, and for the same reasons soft woods take preference over the harder varieties. Among the former in common use in the British Isles are northern pine, larch, white fir, and occasionally pitch pine. In France and Southern Europe cluster pine, maritime pine, stone pine, and possibly cedar, being the local timbers, would be more extensively used.

To the absence of a common definition may be attributed the confusion that exists in respect to the [illegible] pine. The trees producing the wood are common to the British Isles under the name of Scotch fir; experts appear to hold the opinion that the correct name should be Scots pine. It is found chiefly in Scotland, but is very common on the Bagshot sand formation in Surrey and Berks; it is also found on the lower greensand. The timber in general use has been imported from Sweden, Norway, Russia and Germany.

A common practice in specifying is to describe the wood by one or more of the following names: Red fir, yellow fir, red deal, yellow deal, red pine and yellow pine. It is the general custom of quantity surveyors to use the names "deal" or "fir" to define rough or wrought wood—wrought deal for joinery and rough fir for carcase work.

The colour of the wood depends upon the soil in which it has grown and varies from dark straw with a red tinge to a pale straw, nearing the whiteness of the wood of the *Abies excelsa*. A typical specimen may be taken as pale straw with honey-coloured grain markings.

Timber formerly shipped from Memel and other Baltic ports is of a reddish hue, and especially useful for joinery of fair class. This colouring must not be confused with the carmine tint, arising from a form of decay due to felling at improper season.

To avoid misdescription the author suggests that the timber should be referred to as "fir," qualified, from its usual yellow colouring, as yellow fir to distinguish from the white fir. As it can be obtained under some 2,000 different brands that denote shipping ports and grades of quality, there are all-sufficient means for minute description without confusion.

Deal is the correct name for fir timber 9 in. or 11 in. in width, and not greater than 6 in. and not less than 2 in. in thickness, and this name should be adhered to instead of the practice of referring to deal battens, deal planks, &c.

The use of the names "red" and "yellow" pine should be confined to Canadian red pine (*Pinus resinosa*) and the American yellow or white pine (*Pinus strobus*), also known as "cork pine" from its softness, and Weymouth pine, after Lord Weymouth, who introduced the tree into this country. The Canadian red pine takes its name from the red colouring of its bark; the wood is of whitish colour. The wood of the Sequoia pine (*Sequoia gigantea*) and the redwood (*Sequoia semper*) have occasionally been described as red pine, and, although from a colour point there is a strong claim, the common names of these trees are sufficiently distinct to warrant the use of no other.

The white fir, or spruce, is often described as white deal. Botanists do not appear unanimous in respect to this tree, as various writers use some seven or eight Latin distinctions; but the most common appear to be *Abies excelsa* and *Picea excelsa*. The wood is easily distinguished from the yellow fir by its extreme whiteness, and in good specimens by, in addition, the flowery glint of the medullary rays. Although commonly used in barrack construction, it is unsuitable for external work, as it does not "weather" well, and is liable to crack and warp. The best qualities are useful for internal joinery, especially for stained work. Medium grades may be used for upper floors and possibly for inside match-boarding, but the lesser qualities are not desirable in building works, although useful for making packing cases.

The American yellow pine is useful for internal joinery, but should not be fixed outdoors; as with white fir, inferior qualities are suitable only for cheap box manufactures. The larch (*Larix Europae*) is a home-grown timber that may be used for external work, but is rarely obtained in girth sufficient to warrant its use other than as posts, rails or poles. More attention appears to be given to the time for felling the larch than to the other British soft timbers, which appear to be cut irrespective of season or maturity, and consequently are not comparable commercially with the imported woods.

Pitch pine is strong, and in ventilated positions durable. In America the name refers to the wood of the *Pinus rigida*, but experts claim that the pitch pine used in England is obtained from the Georgia pine (*Pinus Australis*). These woods are more costly than yellow fir, and, being very resinous, are of an inflammable character; thin boards are liable to split or warp.

The wood of the Oregon pine or Douglas fir (*Pinus Douglassii*) has an appearance like the pitch pine; it is very hard, but has not the "sticky" characteristics of the pitch pine, although it is said to be equally inflammable. A much similar wood is imported under the name of Carolina pine. This I cannot trace as a distinct species, and believe it must belong to the species *Pinus Douglassii*.

Bass wood is often used in the manufacture of doors, more especially those imported from America. The wood known in the British workshops under this name is obtained from the Tulip tree (*Liriodendron tulifera*), more commonly named in the United States canoe tree wood, owing to its extensive use for making dug-out canoes, or saddle tree wood from the appearance of its palmate leaves, the upper edge of which is similar in shape to a saddle. The timber is of canary colour varying to light green. It should be noted that tulip wood is obtained from a totally different tree—the *Physocalymna Florida* of South America.

The timber known in America as bass wood is of extreme white colour, with indistinct grain markings, and is obtained from the linden (*Tilia Americano*). Both "bass woods" are suitable for internal doors.

In Southern Europe the following pines are common: Cluster pine (*Pinus pinaster*), the stone pine (*Pinus pinea*), and the Maritime or Corsican pine (*Pinus Laricio*). The trees of these species have many similarities to the *Pinus sylvestris*. Differences occur in the cluster pine, which has a coarse bark with vertical fissures, a much larger cone, and longer needle leaves. The stone pine has exceedingly large, hard cones, and long "needles." The timbers of both these trees are inferior to the northern pine.

To the botanist there is a distinction between the maritime pine and the northern pine. As with spruce, authorities disagree as to the correct naming of the former in Latin. Throughout Southern Europe it is found in a wild state and under varying local names. The colour of the wood varies according to the soil in which it grows. The bark, needles and cones of this tree are similar to those of the Scots fir, and the general appearance of both trees is alike, except that possibly the Corsican pine is nearer pyramidal in shape. The timber is generally similar to that of the yellow fir, is equal in quality for constructive purposes, and for general description might be classed as the Southern fir.

(To be continued.)

Horse *v.* Traction Haulage.—Referring in his annual report to the subject of the removal of house refuse, Mr. J. Siddalls, the borough surveyor of Tiverton, states that in that town the practice up to the present has been to deposit the material in a field. "The steepness of the road leading to this place of deposit has," says Mr. Siddalls, "materially increased the labour and cost of horse haulage, and it becomes a serious question whether this work should not now be done by traction haulage instead of by horses. While the war is in progress it will not be possible to purchase an engine and trucks, but I trust that at the first favourable opportunity the council will do so, as I am convinced that in combination with the work of stone hauling a great saving will be effected, and much of the present inconvenience prevented."

New Municipal Building, Aberavon.*

By JAMES RODERICK, Borough Engineer.

The new arcade and municipal building at Aberavon is one of the largest structures hitherto erected in the district, and has been completed at a cost of nearly £15,000. The premises occupy a prominent position in the centre of the town adjoining the new market, which was opened in 1909, and are situated within one minute's walk of the railway station.

The building, of which a general view is given in Fig. 1, has three frontages to the main streets—116 ft. to Church-street, 69 ft. facing the Prince of Wales' Hotel, and 109 ft. to Water-street. Having such extensive frontages the building has given ample opportunity for massive treatment, and the interior is quite in keeping with the monumental proportions of the exterior.

The project included the construction of a large block of buildings with eighteen lock-up shops on the ground floor, and municipal offices and police court on the first floor. The three main elevations of the building have grey Forest of Dean stone dressings with Cattybrook red brick facings.

The main entrance to the arcade is designed with four stone columns, having alternate square and circular blocks of stone finished on top with Ionic capitals, and surmounted by a cornice and moulded cornice over. The large pilasters at the corners of the building are similarly treated, as also are the main windows in the front. Above the coping the building is finished by a parapet with gable tops and stone balusters, and a stone clock tower rises boldly from the roof to a height of 60 ft. above pavement level.

Aberavon Municipal Building. Principal Front and Entrance to Arcade (Fig. 1).

There are four entrances to the arcade—from Church-street, the Prince of Wales' Hotel Approach, Water-street, and the new market respectively. On plan the arcade is the shape of a cross, with a through entrance from Water-street to Church-street, and another from the Prince of Wales' Approach to the new market. The arcade is covered with steel roof trusses and Hope's patent glazing. It is well lighted, and is sumptuously decorated. The nine shops in the arcade have mahogany fronts, and the fronts of the nine shops on the outside of the building were executed in teak. Fig. 2 is a plan at first-floor level, showing the arrangement of the municipal offices and the police court. The names of the streets below are added for the convenience of readers. Figs. 3 and 4 are further drawings illustrating the subjoined description of the building.

The entrances to the municipal offices and the police court on the first floor are three in number. That to the municipal offices is from Water-street, and the police-court section has two entrances from Church-street—one for general use and the other for the conveyance of prisoners to the lock-up cells.

Passing in at the main entrance in Water-street one comes into a spacious entrance hall, which is paved with an elaborate design of mosaic. The principal staircase is executed in Mouchel-Hennebique ferro-concrete, the treads being grooved and finished by a patent process embodying the use of steel dust embedded in the concrete, so as to provide a non-slippery and wear-resisting surface. The handrail is in polished mahogany.

At the top of the staircase there is a wide corridor, which leads to the municipal offices, accommodation being provided for the following: Overseer, rate-collector, accountant, sanitary inspector, town clerk, surveyor, and surveyor's staff. A branch corridor leads from the top of the staircase to the council chamber and the committee room. The council chamber is elaborately furnished, and is executed in Austrian oak. Around the walls of the chamber is a panelled dado 6ft. high with enriched plaster panelling above. The ceiling is panelled in enriched plaster drop moulds, with a 20-in. girt plaster cornice. In the centre of the roof is a large lantern light, with an enriched plaster frieze. The seating for the council is circular on plan, the seats being divided up into sections arranged radially, so that the occupants look towards the centre. The seats are of tip-up pattern, with a separate locker for each member, the arms being carved and the backs and seats upholstered in morocco leather. The mayor's chair is elaborately finished, with the new borough arms carved on the back. On each side of the mayor's seat are two fixed tables—for officials and the Press. A long seat is also provided in the chamber for the public.

The police court is separated from the municipal offices by interior walls, and, as stated previously, has entrances of its own. The main staircase is similar in design and construction to that on the Water-street front of the building. The police-court furniture is of pitch-pine, stained and varnished.

The court is designed on modern lines, and its accommodation and ornamentation will compare favourably with other police courts in South Wales. Leading to the court-room are four separate entrances—three for the public, prisoners, and solicitors, respectively, and one for the magistrates—from the committee-room, which is to be used as a magistrates' retiring-room.

Provision is made for five lock-up cells for male prisoners, and an equal number for female prisoners. Situated on the right of the first-floor corridor leading from the police court staircase are rooms for police

* Illustrated on the 17th September *Reco Concrete*.

offices, witnesses, and visitors. All the offices in the building are heated by gas stoves, and the police cells are heated by the low-pressure hot-water circulating system. The shop floors on the ground floor are laid on wet pre-wood block, bedded

Fig. 2.—Ground Floor Plan.

and the various sporting rifles on the first floor have pitch-pine flooring.

On the first floor of the municipal offices side of the building ferro-concrete stairs lead to the flat roof and clock tower. The clock, which has dials 10 ft. diameter, is of the electrical type and was supplied by Messrs. Gent & Co., of Leicester. The building is of fireproof construction throughout, the floors and roof and staircases being constructed in Mouchel-Hennebique ferro-concrete in accordance with the working details prepared by Messrs. L. G. Mouchel & Partners, Limited, of Westminster.

In the ground floor [illegible] the ferro-concrete work consists mainly of columns for the support of lintels carrying the exterior and interior walls of the upper storey, and also for the support of ferro-concrete floor beams and arches over the arcade entrances. Part of the ground floor itself is also of ferro-concrete, and so are the stairways communicating with the basement and the first floor.

With the exception of the [illegible] walls and the area occupied by the arcade, the whole of the upper storey is constructed in ferro-concrete. Some portions of the flooring are of the beam and slab type, but the larger proportion is constructed on the Mouchel patent hollow monolithic principle, the supporting beams being formed between rows of concrete tubes about 2 ft. 3 in. wide by 10 in. high, and covered by 2½ in. of concrete. The result is a floor presenting a perfectly level soffit, suitable for plastering, and offering most effective resistance to transmission of sound and heat.

All the stairways and flat roofing are also of ferro-concrete, thus affording means of intercommunication which cannot be destroyed by an outbreak of fire inside the building, and protection against the risk of fire from the exterior.

The whole of the ferro-concrete construction is in accordance with Mouchel-Hennebique standard practice, now so well known that it is unnecessary to give detailed particulars in this article.

The building contract was carried out in a highly efficient manner by Mr. Morgan Cox, of Abergavenny, from the designs of the writer, who has received every assistance in the superintendence of the work from his assistant, Mr. Fred. T. Cox. Mr. Ivor Owen Lewis, of Abergavenny, acted as clerk of works, and Messrs. Mouchel & Partners, Limited, were represented by Mr. Robert G. Clark, ASSOC.M.INST.C.E., their district engineer for South Wales. The ferro-concrete work was executed in an entirely satisfactory manner by Messrs. W. Thomas & Co., of Cardiff.

Fig. 3.—Water Street Elevation.

This drawing shows the front elevation of the municipal offices, the west return of the police cells, and the left-hand side of the lock-up in the yard.

Fig. 4.—Longitudinal Section.

This drawing is a section on the centre line in Fig. 2, and shows the interior of the arcade. The large room on the first floor is the police court.

ABERGAVENNY MUNICIPAL BUILDING.

Road Tarring.—In his report for the year ended March 31st last, Mr. J. Siddalls, the borough surveyor of Tiverton, states that during that period the surface tarring of the roadways of that town was extended to the secondary streets, where the advantages of the process were even more [illegible]

Law Notes.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only, and addressed to "The Editor," at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—*i.e.*, without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter X. com. binations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.*

BUILDING BY-LAWS: "NEW BUILDING."—"Dubious" writes: My council on the 19th day of March, 1914, adopted by-laws with respect to new buildings, and certain matters in connection with buildings in their rural district which were allowed by the Local Government Board, the 25th day of April, 1914. A firm of builders—Messrs. A—commenced extensive additions to a house situated in my council's district for the owner, Mr. B. But no plans of any description were submitted, nor notice of any kind given to me or the clerk of my council intimating that these building additions were about to commence. Hearing from some one other than the builder or the owner that these buildings were in progress, I inspected the site and found that the original house, which was a large country house of a private gentleman, was having extensive additions attached thereto in the shape of a new kitchen, butler's pantry, servants' hall, scullery, coal-house, and water-closet, with bedrooms, bath-room, and water-closet over, on one side, a large drawing-room, 22 ft. by 24 ft., with bedroom and dressing room over, on the other side, together with a considerable length of additional drainage, including inspection chambers, vent pipes, and so on. Being under the impression that these additions constituted new buildings, to which the above-mentioned by-laws apply, I reported to my council the fact that this work was in progress prior to plans or notice of it having been given, and that the builder was acting in contravention of the by-laws. The clerk of my council ruled that, as our by-laws were made under the Public Health Act, 1875, and as my council had not adopted the Public Health Amendments Act of 1890 or the Act of 1907, these additions did not constitute a new building or new drainage under their by-laws. In consequence my council decided to take no action in the matter, nor require plans to be submitted to me by the builders—Messrs. A. The points, therefore, that I should be glad of your opinion on are: (1) Do these additions constitute a new building to which our by-laws apply? (2) Does the new drainage come under these by-laws? If so, (3) are Messrs. A, who have now submitted plans on behalf of Mr. B, the persons against whom my council should take action?

(1) Apart from the provisions of the sections referred to, and of sec. 159 of the Public Health Act, 1875, it is a question of fact whether in any particular case a building is a "new building" (*James* v. *Wyrill*, 1884, 48 J.P., 725). In the case now submitted the additions are, in our opinion, so substantial as to enable the justices, if they were so minded, to hold that they constituted a "new building." (2) Yes, if the justices hold that the work constitutes the erection of a "new building." (3) We think, yes.

CELLAR FLOODED FROM SURCHARGED SEWER.—"Idris" writes: Thirty years ago a slop sink in a cellar underneath a grocer's shop was connected with the local authority's sewer. Three years ago the cellar was flooded owing to the sewer being overcharged and working back through the sink into the cellar. The occupier of the premises fixed a back-pressure trap on his drain to prevent a recurrence of the nuisance. It now transpires that there is an old land drain conveying surface water in the floor of the cellar which is connected to the sink, and in times of heavy rain this surface-water channel, having no outlet though the drain into the sewer (it being sealed by back pressure from sewer) floods the cellar. There are also several weepings of water through the cellar walls. The surface-water drain does not take any water from the roads or property of the local authority, but seems to collect the ground water, and was probably in existence before the premises were erected. (1) Has the occupier of the premises any claim on the local authority for damage to his stock through flooding by this surface-water drain, or (2) can he compel the local authority to provide an outlet for this surface water from his cellar? He contends that, having enjoyed the privilege for twenty years or so, the local authority are responsible for the carrying away of this water. There are no by-laws in force in the district dealing with such cases, nor are there any local Acts.

(1) We think not. By sec. 15 of the Public Health Act, 1875, it is provided that "every local authority . . . shall cause to be made such sewers as may be necessary for effectually draining their district . . ."; and by sec. 19 all local authorities have cast upon them the duty of causing the sewers belonging to them to be constructed, covered, ventilated, and kept so as not to be a nuisance or injurious to health, and to be properly cleansed and emptied. No action will lie, however, for injury caused by a mere omission under either of these sections, in the absence of negligence. (2) His proper remedy appears to be to appeal to the Local Government Board under sec. 299 of the Act.

DANGEROUS STRUCTURES.—"Doubtful" writes: In my district four houses have been in a ruinous, dangerous, and unoccupied condition since 1907. A closing order was made twelve months ago (the property at that still being unoccupied), and a demolition order was being proceeded with when an injunction was granted to the owner to prevent the order being carried out. But, counsel having advised that for purely technical reasons it was unadvisable to defend the action, it was not defended, and the closing order is dead. As the property is a great source of danger to the public, it is now proposed to serve a notice, under sec. 75 of the Towns Improvement Clauses Act of 1847, but, the property being unoccupied, of no value, and the owner residing outside the district, and apparently having no means, I should be glad to have your opinion as to the advisability of proceeding under this Act, and serving a notice on the owner residing out of the district. I might say that if there is a possible loophole on technical grounds the owner will take every advantage of it. Perhaps you would be good enough to let me know what line of action you would advise.

It is at least arguable that the machinery provided by sec. 75 of the Towns Improvement Clauses Act, 1847, is not applicable to the circumstances of the case submitted—*i.e.*, where the owner is not resident within the district and there is no occupier—for the section seems to regard the putting of the notice on the door or other conspicuous part of the premises as notice to the occupier rather than to the owner. If, therefore, the owner is inclined to be litigious, he will probably contest the action of the local authority on this ground, and in the absence of authority it is difficult to see what view the Court would take. It would probably be safer for the local authority to proceed *de novo* under the Housing, Town Planning, &c., Act, 1909, by making a fresh Closing Order, care being taken to follow strictly the procedure laid down by the Statute, and particularly the wording of the prescribed forms. A Closing Order can be made in respect of an unoccupied house (see the amendment of the definition of "dwelling-house" in sec. 49 (1) of the Act of 1909, and *Robertson* v. *King* (1901), 2 K.B., 265).

DANGEROUS BUILDINGS.—"A. Z." writes: Which officer in an urban district is responsible for the inspection and dealing with dangerous buildings? It would appear that, under the Towns Improvement Clauses Act, the surveyor is the officer where buildings are dangerous to passengers on a highway. Should he also inspect his district for structures likely to be dangerous only to those occupying them, or should this work come within the province of the sanitary inspector? If the latter officer is the person to deal with such structures, does he treat such building as a nuisance under sec. 91 of the Public Health Act, 1875?

The duties of the surveyor under sec. 75 of the Towns Improvement Clauses Act, 1847, are confined to the case of buildings, &c., which are "in a ruinous state, *and* dangerous to passengers or to the occupiers of the *neighbouring* buildings." A structure likely to be dangerous only to its occupiers may be as either (1) because of purely structural defects, or (2) because it is "in such a state as to be a nuisance or injurious to health" within the meaning of sec. 91 of the Public Health Act, 1875, or (3) because it is "in a state so dangerous or injurious to health as to be unfit for human habitation" within the meaning of sec. 17 of the Housing, Town Planning, &c., Act, 1909. As to (1), there is no power, so far as we are aware, to deal with a building dangerous only to its occupiers because of purely structural defects, unless it comes within the rental limits prescribed by sec. 14 of the Housing, Town Planning, &c., Act, 1909. For this purpose the inspection is made by any person authorised in writing by the local authority (sec. 15 (2)), who may thus appoint either the surveyor or the sanitary inspector. As to (2), in this case inspection would be by the sanitary inspector. As to (3), in this case the

The Surveyor
And Municipal and County Engineer

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Inspection must be either by the medical officer of health or by an officer appointed by the local authority but acting under the direction and supervision, instead, the sanitary inspector. See the Local Government Board Housing, Inspection of District, Regulations, September 2, 1919.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Carlisle T.C. (September 16th. Mr. Edward Leonard). £9,882 for the erection of thirty-six working-class houses.—The town clerk, Mr. A. H. Collingwood, stated that there were no working-class houses empty in the city. There was a great deal of overcrowding and unfit houses, but the council were hampered in dealing with the matter on account of the lack of accommodation. He also anticipated that there would be a big demand for houses in Carlisle. Whether it was for the authorities to provide them was quite another matter. The inspector pointed out that, there being a deficit of about £120 annually on the capital charges, it would require the rents to be 7s. 3d. a week, and not 5s. 3d. as proposed, to make the scheme self-supporting.

APPLICATIONS FOR LOANS.

Hayes U.D.C.—£300 for street works.

Ilford U.D.C.—£870 for a generating station.

Shrewsbury T.C.—£22,030 for the erection of 100 houses, and £1,500 for street works.

LOANS SANCTIONED.

Belleek R.D.C.—£4,080 for labourers' cottages.

Carlisle T.C.—£1,063 for road improvement.

Huntingdon T.C.—£10,000 for forty workmen's houses.

Lowestoft T.C.—£7,500 for sea defence works.

York T.C.—£7,374 for the erection of cottages, £2,500 for the erection of weights and inspectors' offices, and £800 for a new street.

LOANS REFUSED.

Walsall T.C. £10,000 for widening Lower Bridge street.

West Bromwich T.C.—£988 for a school clinic.

FORTHCOMING INQUIRIES.

OCTOBER.

TOWN PLANNING.

8.—**Hunslet.** (Mr. Raymond Unwin) ... —

DEPTFORD BOROUGH SURVEYORSHIP.

WIMBLEDON DEPUTY APPOINTED.

Mr. F. Wilkinson, deputy borough engineer and surveyor of Wimbledon, was on Tuesday appointed borough surveyor of Deptford, at a salary of £450 per annum.

Mr. Wilkinson was educated at the Higher Grade School, Bacup, and the Municipal School of Technology, Victoria University, Manchester. He was apprenticed to Messrs. Howard & Bullough's, Limited, mechanical engineers, Accrington, and gained six years' experience in this branch of engineering. In January, 1900, he was appointed engineering assistant to the Corporation of Rawtenstall.

MR. F. WILKINSON, ASSOC.M.INST.C.E., A.M.I.MECH.E.,
The new Borough Surveyor of Deptford.

In May, 1903, the borough engineer of Rochdale (Mr. S. S. Platt, M.INST.C.E.) offered him the appointment of engineering assistant in the tramways and bridge department in his office, which he accepted. He was engaged in supervising the construction of the tramways, which were carried out by direct labour. In April, 1907, he was appointed by examination, out of nearly 200 candidates, the deputy borough engineer and surveyor of Wimbledon, under Mr. C. H. Cooper, M.INST.C.E., and he has since carried out many important works, including an open-air bath at Wandle Park, sewers, underground conveniences, filters, additions to the sewage farm, an extension to electric light works, the laying out of recreation grounds, additions to the isolation hospital and baths, and school work, including a manual training centre and cookery school.

Mr. Wilkinson is an associate member of the Institution of Civil Engineers and of the Institution of Mechanical Engineers, a member of the Institution of Municipal and County Engineers and of the Royal Sanitary Institute, and is a certified sanitary inspector.

Dormitory Space in Public Institutions. In the House of Commons on Tuesday the President of the Local Government Board was asked what was the recognised cubic space per individual in dormitories of institutions under the Local Government Board; whether the rules and regulations about air space and numbers allowed in recognised and inspected institutions had been altered, relaxed, or suspended since the war; if so, in how many cases; and how many individuals had been so adversely affected. Mr. Long said the recognised cubic air space per person in Poor-law institutions varied from 300 ft. to 2,000 ft., according to the class of persons occupying the dormitories. The certified accommodation of four metropolitan institutions had been temporarily increased to a slight extent since the war, but the greater part of this increase was due not to a relaxation of the general rule, but to an increase in the number of rooms used as dormitories, and he was not aware that any persons had been adversely affected thereby.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

Mr. E. Hodgkiss, of Walkden, who was awarded the premium for August, has selected—

Pitt Rankine "A Manual of Civil Engineering" (Griffin), and

"Waterworks Distribution," by J. A. McPherson (Batsford).

and they have duly been sent him.

QUESTIONS.

This week answers are invited to the following questions:—

500. Sewage Tank.—A sewer discharging into a sea outfall is connected to a storage tank l feet in length, b feet in breadth, and h feet in height. The tank discharges directly into the sea by means of an orifice a square foot in area, connected to low-water level by a short pipe of the same area, the top of the tank being at high-water level. Neglecting losses due to friction, and assuming that no sewage is admitted to the tank during the period of emptying, that the tide has a range of r feet, and that the tide curve is harmonic, find approximately the time taken to empty the tank. (Stud.Inst.C.E.)

501. Ventilation.—In designing a system of ventilation for a public hall, what are the relative advantages of a small number of large inlet shafts, compared with a large number of small shafts; and at what level should these inlets be placed? (C. W. P., *Wellington.*)

502. Theory of Beams.—The cross-section of a beam is T-shaped, the upper table is 6 in. wide and 1 in. thick, the vertical web is 5 in. deep and $\frac{3}{4}$ in. thick. At a certain cross-section this beam is subjected to a known bending moment. Make a careful sketch to show the distribution of the stress across the section produced by this bending moment. (C. W. P., *Wellington.*)

503. Sewer Construction.—AB and CD are two 18-in. stoneware pipe sewers, intercepted at right angles by a railway in a cutting with slopes of 1 in 2. The fall of AB is 1 in 140 and CD 1 in 360. The invert level of B is 122·5; C=120·75; ground level 128·0, and level of railway metals 106·50 ft. above ordnance datum. Distance from B to C is 110 ft. Describe and show by sketches in detail how to connect the sewers AB and CD, showing provision for cleaning and inspection. The fall of both sewers is towards D. The railway company will not allow any sewer to pass underneath the railway unless at a greater depth from top of sewer to top of rails of 4 ft. (E. H., *Walkden.*)

504. Bridge Design.—A bridge is required to carry a 60-ft. street over a canal, the clear span being 40 ft., the minimum head room being 11 ft. at centre and 9 ft. at sides above normal water level. The approaches are rising gradients of 1 in 24 and 1 in 90 respectively. Sketch the bridge you recommend for such a position, giving all important particulars, short specification tests for materials, and tests for bridge when completed. (P. W., *Pontypridd.*)

505. Retaining Wall.—Design a retaining wall in reinforced concrete, giving detailed calculations. The height of proposed wall 35 ft., earth retained, dry gravel; foundation similar. (H. T.)

REPLIES TO QUESTIONS.

499. Geodesy.—Describe generally (without details) the astronomical observations needed to locate the starting-point of a survey in a new country. (E. P. C., *Birmingham.*)

Before considering the necessary observations to be made it would be well to quote a few astronomical terms by way of explanation: Latitude is the distance of any point on the earth's surface north or south of the Equator measured on a meridian; co-latitude or zenith distance is 90 deg.—altitude; longitude is the spherical angle at the pole between the meridian of Greenwich and the meridian of any place on the earth's surface; meridian is the great circle passing through the poles and the observer's position; zenith is the point directly overhead the observer's position; altitude of a celestial body is the vertical angle between the horizon and the body; declination is the distance of a celestial body north or south of the Equator measured on a meridian; co-declination is 90 deg.—declination; local mean time is the time used in everyday life; right ascension of a celestial body corresponds to the longitude of a point on the earth, and is measured from west to east, and expressed in hours, minutes and seconds, and twenty-four hours = 360 deg. To locate a fixed point in a new country is a similar operation to finding one's position at sea, and the observations necessary are those which enable us to find the meridian or true north latitude and longitude. To find the meridian or true north through the starting-point is very important, as from it the true bearings of any line are found. To do this equal altitudes of a circumpolar star should be observed. Set up the theodolite over the starting-point on a base line of the survey, and sight a circumpolar star and measure the horizontal angle between this line and the star, and also note the vertical angle. Now clamp the upper plate of the instrument and follow the star until it has an equal altitude on the opposite side of the pole, and again read the horizontal angle from the given base line. The mean of these two angles is the angle between the meridian and the line whose bearing is required. The most accurate method for finding the latitude is by the meridian altitude of the sun or star. A theodolite is set up over the starting-point, and the meridian altitude of the sun or star is measured (*i.e.*, its altitude at culmination). Then the zenith distance = 90 deg. altitude. The sum or difference (according to the culmination—upper or lower) of the co-declination, found from the Nautical Almanac, and the zenith distance is the co-latitude, and the latitude = 90 deg.—co-latitude. Longitude by moon culminating stars.—This is, perhaps, the best method for finding the longitude. It consists in observing the local mean time of the meridian transit of the moon's bright limb, and also the local mean time of the meridian transit of a fixed star near the moon, and whose right ascension is known. A list of stars, called "Moon Culminating Stars," is given in the Nautical Almanac. From the time interval between the culminations, the right ascension of the moon's bright limb at the instant of the observation may be found. In the Nautical Almanac the right ascension of the moon's bright limb is given for every hour for both upper and lower culminations, and the variation in right ascension is also given. By interpolating between the values of the right ascension given in the Nautical Almanac we can find Greenwich mean time corresponding to the moon's right ascension at the time of observation. The longitude in time is then the difference between the local mean time and Greenwich mean time of observation. This, converted into degrees, gives the longitude in degrees. In taking star observations it will be necessary to illuminate the cross hairs; otherwise they would be invisible. This is generally done by a small lamp fixed near the horizontal axis of the telescope, which is made hollow and has a piece of glass at its extremity to admit the light. In observations of the sun it will be necessary to interpose a piece of coloured glass between the eye-piece of the telescope and the sun. (J. G. W., *Dewsbury.*)

The data required for the commencement of a survey in unmapped country are as follows: (1) Meridian, or true north; (2) latitude, or distance north or south of the Equator; (3) longitude, or distance east or west of a given meridian—such as that passing through Greenwich; (4) local mean time.

(1) There are numerous ways of finding meridian,

but the one usually adopted by surveyors is by one extra meridian observation of sun or star. The former body is most commonly used, and the azimuth of the observed body is obtained from the formula—

$$\cos \tfrac{1}{2} \text{ azimuth} = \sqrt{(\sin s \sin (s - \text{codec}) \operatorname{cosec} \text{colat} \operatorname{cosec} \text{codec})}$$

$$\text{where } s = \tfrac{1}{2}(\text{colat} + \text{coalt} + \text{codec})$$

The coalt is got from the observed altitude obtained with the theodolite, the latitude either from a map or as in (2), from which one can obtain colat = 90 deg. — lat, and the codec from the Nautical Almanac. It should be noticed that when observations are made in the northern hemisphere the true bearing of the observed body is equivalent to 360 deg. — azimuth if the body is to the west of meridian, while if east of meridian it is equal to its azimuth. Should the observations be made in the southern hemisphere, the true bearing will be 180 deg.—azimuth if observed body is to east of meridian, and 180 deg. + azimuth if to west of meridian. Correction for refraction, parallax and semi-diameter are omitted, as details are not required. Local mean time of observation by watch and longitude are required to find accurately the declination of the sun, the latter being obtained from (3) and the former from (4). The horizontal angle between the survey line and the sun's centre is also observed, and from this angle and the azimuth is obtained the required true bearing of the survey line.

(2) Latitude.—This can be calculated in a similar manner to the above, but the method most suited to the surveyor is to take an observation of the altitude of a celestial body at its culmination, correcting the same for refraction, parallax and semi-diameter. The Nautical Almanac will give the declination of the body, and from these facts we can find the latitude according to the following rules:—

Northern Hemisphere.—If the body culminates to north of observer,

(a) Altitude observed at upper culmination, lat = alt — codec.
(b) altitude observed at lower culmination lat = alt + codec.

If the body culminates to south of observer

(c) when declination of body is N colat = alt — dec.
(d) when declination of body is S colat = alt + dec.

Southern Hemisphere.—If the body culminates to north of observer,

(e) when declination of body is S colat = alt — dec.
(f) when declination of body is N colat = alt + dec.

If the body culminates to S of observer

(g) altitude observed at upper culmination lat = alt — codec.
(h) altitude observed at lower culmination lat = alt + codec.

If the meridian has already been formed, then, with coalt, codec and azimuth given, we have

$$\sin \text{hour angle} = \frac{\sin \text{coalt} \sin \text{azimuth}}{\sin \text{codec}}$$

The latitude is then obtained from the formula—

$$\tan \tfrac{1}{2} \text{ colat} = \frac{\sin \tfrac{1}{2}(\text{azimuth} + \text{hour angle})}{\sin \tfrac{1}{2}(\text{azimuth} - \text{hour angle})} \cdot \tan \tfrac{1}{2}(\text{codec} - \text{coalt})$$

(3) Longitude.—This is most usually obtained from a chronometer. The local mean time having been found (see [4]), it is compared with Greenwich time as indicated by the chronometer, the difference being the longitude in mean time. This is converted into degrees, and we then have the required longitude. It is obvious that the accuracy of the result depends upon the correctness of the chronometer, and should the longitude be required very accurately it is best found from observations of moon culminating stars. The method is to observe the local mean time of the meridian transit of a fixed star near the moon whose right ascension is known. The right ascension of the moon's bright limb at the instant of observation can be found from the time interval between the culminations. Suitable moon culminating stars may be found from the Nautical Almanac, in which is given also the right ascension of the moon's bright limb for every hour for upper and lower culmination. The Greenwich mean time of observation of transit of moon's bright limb or the Greenwich mean time corresponding to the moon's right ascension at the time of observation—can be found by interpolating between the values of the right ascension given in the Nautical Almanac, and it is obvious that the longitude in time is the difference between local mean time and Greenwich mean time of observer. This is converted into degrees in the ordinary way.

(4) Time.—The extra meridian observation of sun or star, as in (1) and (3), is the best method of obtaining local mean time. If we have given colat, coalt and codec we have

$$\sin \tfrac{1}{2} \text{ hour angle} = \sqrt{\left(\frac{\sin (S - \text{codec}) \sin (\sin \text{colat})}{\sin \text{codec} \sin \text{colat}}\right)}$$

Should azimuth be given, we have as before

$$\sin \text{hour angle} = \frac{\sin \text{azimuth} \sin \text{coalt}}{\sin \text{codec}}$$

It is necessary to note that the hour angle is the interval of time in degrees between the time of observation and the time of culmination. The time of culmination of the observed body must be known, the time of culmination of the sun being 12± equation of time. The hour angle must be converted into hours, minutes and seconds, and subtracted from the time of culmination when observed body is east of meridian, and added when body is west of meridian. The result is the true local mean time of the observation. The Greenwich mean time of observation should be noted. In all observations both faces of the instrument should be used. No attempt has been made in the above to explain the terms alt, dec, &c., but they can be readily understood on reference to any standard work on geodesy. (B. K. *Newport.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

PERTH'S PROPOSED WATER AND SEWAGE DISPOSAL SCHEMES.

The Special Water and Sewage Committee appointed by the Perth Corporation has prepared for the consideration of the town council a report on the proposed water and sewage disposal schemes. The report, which is signed on behalf of the committee by Lord Provost Scott as chairman, states that from a consideration of the report submitted by the engineers it will be seen that the estimated cost of the various water schemes reported on, as modified, is as follows: —

Bertha scheme No. 1	£101,000
Bertha scheme No. 2	86,000
Stormontfield scheme	105,250
Water of May scheme	192,500

In order to arrive at a fair comparison between the Bertha schemes and the Stormontfield scheme there would have to be deducted from the cost of the last-mentioned scheme the extra cost of damming at Bertha—namely, £300 per annum—at thirty years' purchase, equal to £9,000.

While a gravitation supply is to be preferred, it is thought the initial cost is very much more than that of any damming scheme. The difficulty of obtaining such a supply owing to the site of the town and the configuration of the surrounding country makes it almost impossible to realise this idea unless at an expense beyond the power of the community.

The estimated cost of the city's disposal scheme, which provides for the extension of the existing outflow sewer to the electricity station and the erecting of screening-house and other necessary works, amounts to £20,000.

Apart from the consideration of the water supply, the committee thought that the removal of the crude sewage was wholly desirable on sentimental grounds, but more especially in the interests of the salmon fishing on the Tay, in which the city has so much at stake. The committee is encouraged to hope that if this work is undertaken on the lines suggested considerable monetary assistance would be received from the proprietors of the salmon fishing.

Sanatoria.—The Local Government Board have issued a revised list of sanatoria and other residential institutions approved by them under the National Insurance Act, 1911, for the treatment of persons in England (excluding Monmouthshire) suffering from tuberculosis.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Why is it that there are still appearing advertisements asking for contracts for the removal of house refuse, emptying of middens, and so forth? Has it not long ago been proved that this service is far more satisfactorily performed by the local authority under their own administration and at less cost to the ratepayers? Apropos of such contracts, is it a fact that in a large camp "somewhere in England" a contract of this kind was entered into by the military authorities, the contractor receiving £140 a week for the work? Is it true that the local surveyor entered into a little calculation based on the highest possible cost of labour and team work, and estimated the cost at only £27 a week? What about war profits and taxation?

* * * *

What are the objections in Cumberland to the use of tar on the roads? Is it not to be deplored that these roads, excellently constructed as water-bound macadam, should be left untreated, with a consequent dust nuisance that even kills the beautiful mosses growing on the stone walls which border the roads? Is the objection based on horse traffic, or is it that the "authorities" wish to squeeze the Road Board into giving grants for the whole of the work of tar-spraying instead of only for a portion of the cost?

* * * *

Why was the county surveyor of Durham selected to advise as to the deplorable condition of the roads near Salisbury Plain? Is this to be reckoned as an acknowledgment of failure on the part of the Royal Engineers or the local authorities? Would it not be well if H.M. Office of Works would swallow their pride and red tape and act in a similar manner with regard to the roads under their jurisdiction?

* * * *

Was not the general meeting of the Royal Sanitary Institute at Brighton well worth attending, if only for the opportunity given for an inspection of the Indian hospital in the historical Pavilion? Is not Colonel MacLeod, R.A.M.C., to be heartily congratulated on the ingenious and scientific manner in which he has designed and carried out the latrines and other sanitary arrangements for the occupants, who are composed of various tribes and castes, each one with his own peculiarities in connection with "sanitary" arrangements?

* * * *

Are there not many other ways of effecting municipal economies than that of stopping very needful sanitary works? Is it safe to stop urgently needed sewer extensions, or additions to sewage disposal works? Should not the water supply of a community be carefully preserved and even extended? What would happen if an epidemic broke out among our troops in training, or even among a civilian population? Is it not an axiom that healthy men make good soldiers, and should we not be on our guard against this cry of municipal economy when we consider the terrible risks that may be encountered unless the most careful judgment and discrimination are used?

* * * *

Should we not be helping to make a stronger and more virile race of men and women if open-air bathing were encouraged where possible instead of in artificially heated swimming baths to be found in towns where there is either the sea or a river? Is not the luxurious and enervating warm bath responsible for a good deal of the slackness which seems to be pervading this country where in former times there were strong, vigorous men who required little or no "State" support, and who were accustomed to, and looked forward to, the daily cold tub?

Water Purification at Morley.—There was formally opened recently in new premises adjoining the Morley Town Council's waterworks at Cragg Vale, Mytholmroyd, a new filtration plant. In the past the water, after leaving the reservoir, has been sand-washed, and then further treated on the outskirts of Morley. The new plant will supersede both these schemes. The water will now leave Cragg Vale direct to the consumer. There are eleven filters, with an average output of 88,000 gallons a day, and the cost of the installation is over £14,000.

SOMERSET ROADS.

POINTS FROM COUNTY SURVEYOR'S ANNUAL REPORT.

In his second annual report as county surveyor of Somerset, Mr. Edward Stead, ASSOC.M.INST.C.E., furnishes the following details relating to the expenditure on the main roads of that county, of which there are 953½ miles, made up of 871·91 miles of rural and 81·59 miles of urban roads.

	£	£	
Audited expenditure, 1913-14—			
Rural main roads	87,588	= 100·46	per mile
Urban „ „	15,859	= 194·36	„
Total ...	103,447	= 108·49	„
Estimated expenditure, 1914-15—	£	£	
Rural main roads	85,919	= 98·54	„
Urban „ „	16,754	= 205·34	„
Total ...	102,673	= 107·68	„
Estimated expenditure, 1915-16—	£	£	
Rural main roads	79,692	= 91·39	„
Urban „ „	17,441	= 213·76	„
Total ...	97,133	= 101·87	„

It should be noted that these sums do not include amounts allowed for establishment charges or those granted towards surface tarring and improvements on rural main roads.

Of the rural main roads 20·21 miles are maintained directly by the county council's own workmen, 446·01 miles are maintained directly by the rural district council's own workmen in nine districts, 71·43 miles are maintained partly by direct control and partly by contract in one district, and 334·26 miles are still maintained by the contract system in six districts. The fourteen urban authorities that have claimed to retain control contain 63·78 miles, and the five contracting districts 17·81 miles of road.

Mr. Stead observes that the outbreak of the war considerably interfered with the year's work, and in some districts it was found impossible to obtain the full supply of materials either for ordinary maintenance or for works under Road Board grants. Considerable rearrangement of the estimates for 1915-16 has been necessitated, owing to the partial stoppage of Road Board grants and the general shortage of labour.

With a view to meeting any emergency that might arise from lack of employment in the county, several schemes for relief works have been prepared or are in preparation, the most notable of which is perhaps a proposed new road between Wells, Cheddar and Weston-super-Mare, the survey for which is well in hand.

HIGHWAY WORK AT TIVERTON.

WAR-TIME DIFFICULTIES.

In his last-issued annual report Mr. J. Siddalls, the borough surveyor of Tiverton, mentions that the surface of the principal main roads for about a mile out of that town were tarred during the twelve months. Owing to favourable weather in the early part of the season the work was done earlier than usual, and the effect was seen at its best, not only with regard to the abatement of the dust nuisance, but also in the preservation of the surface.

"In the case of violent storms," Mr. Siddalls observes, "the damage caused by washing off the binding and loosening the metalling is entirely prevented where the roads are tarred, and a great saving is effected."

The work on the highways was somewhat retarded by the difficulty, in consequence of the war, of getting deliveries of material. Fortunately, however, good stocks had been obtained early in the season, so the inconvenience was discounted to a large extent; but the difficulties in this direction are expected to be much increased during the coming year, both with regard to material and also from the scarcity of labour, as no fewer than fourteen men volunteered or were called up for active service in the early stages of the war, and others left later on.

It will not be possible to do all that is required, but the principal main roads will be kept in as good condition as circumstances will permit, and no work will be undertaken that can, without detriment, be postponed until more favourable conditions prevail.

MUNICIPAL TRAMWAYS ASSOCIATION.

FOURTEENTH ANNUAL CONFERENCE: PRESIDENTIAL ADDRESS.

The fourteenth annual conference of the Municipal [illegible] Association was held at the Surveyors' Institution, Great George-street, London, yesterday morning, when Alderman H. Linsley, J.P., chairman of the Salford Corporation Tramways Committee, addressed the members for the second time in the capacity of president. Alderman Linsley was first elected to the presidential chair in September, 1913, and in the ordinary course of things last year's meeting would have been held at Salford. The outbreak of war, however, necessitated the usual procedure connected with the annual conference being suspended, and a formal meeting only was held in order to comply with the Articles of Association. At that meeting Alderman Linsley was re-elected as president, but the hopes which he then expressed that by the end of another twelve months hostilities would have ceased have, unfortunately, not been realised, and the conference arrangements have therefore again been modified, the agenda, apart from the delivery of a short presidential address and the transaction of formal business, merely providing for informal discussions on tramway matters as affected by the war.

The council of the association, said the president, in his address, had been kept busy with sundry matters which affected seriously tramway interests; for example, during the past year the association had been successful in pressing their claims for protective clauses against the efforts of railway companies to run omnibuses and road vehicles over the public highways. The council had also given close consideration to the vexed question of the allocation of the burden of road maintenance as between road users, and had kept closely in touch, through their Parliamentary agents, with the Government department considering the matter. In that and other important matters the interests of municipal tramways had, he thought they would agree, been carefully guarded and watched, and the association was to be congratulated upon an active and live executive council.

It was recognised that upon many matters of importance it was in the interests of the association to join hands with other similar bodies who had like interests, and with that laudable and proper object in view several conferences had taken place with representatives of other associations—such as the Association of Municipal Corporations, the Tramways and Light Railways Association, the Institute of Municipal Treasurers and Accountants, and the Incorporated Municipal Electrical Association. That gradual welding together of large associations aiming at a common object could not but mean good for all concerned, and was in the interests of municipalities as a whole.

The council had seen that the technical and engineering side of tramway activities should not be neglected, and were taking a keen interest in the development of various types of vehicles which had come into use since the inception of the orthodox tramcar with its wheels and rails, such as the petrol-motor omnibus and the trackless trolley car, and even later still the battery vehicle. A representative had been appointed on a committee of the Incorporated Municipal Electrical Association, comprising representatives of vehicle manufacturers, electric supply companies, and other kindred bodies, which had been formed to encourage the development of electric vehicles.

Technical questions affecting public safety had had consideration, and joint conferences had taken place with representatives of the Tramways and Light Railways Association on the question of [illegible] controllers, which it appeared, according to the Board of Trade, had in the past contributed towards accidents. It was to be hoped that the efforts of our technical men would be rewarded with a measure of success, though the fact must never be forgotten that while the municipal tramways of this country were carrying enormous masses of people every day, the percentage of accidents was extremely low, and it would not be difficult to prove that tramway travelling was about the safest of all methods of mechanical traction at present in vogue.

FINANCIAL QUESTIONS.

The association had not been idle in connection with financial questions as affecting municipal tramways, and they were now busily engaged in negotiations with other associations having similar interests, with a view to obtaining a standard and equitable system of assessment for income purposes in respect of motor omnibuses. They had, in addition, been in negotiation with the Institute of Municipal Treasurers and Accountants with respect to the proper allocation of interest on tramway funds' bank balances and other matters.

It was pleasing to note that the representatives of the institute had agreed with the principle that tramway funds should be fully credited with all the interest which was obviously their due.

Such a world-wide disturbance as was now happening could not fail to have had varying effects on the business undertakings in which they were all more particularly interested—*i.e.*, municipal tramways. He thought it would be admitted that they did form a very important branch of the business life of this country when they found that at the present moment £55,000,000 of capital was sunk in municipal tramway enterprise alone, and over 55,000 employees were directly connected with their several undertakings.

TRAMWAYMEN AND THE WAR.

It was very gratifying to know that, as a result of the appeal to the men of this country to come forward and help to meet the impending danger, over 16,000—or 30 per cent.—of the municipal tramway employees had gallantly responded. Many of these men had nobly laid down their lives in their country's cause, and many more had sustained pain and suffering from wounds and other causes; but their comrades and their employers would, he was sure, see that their names and deeds were not forgotten, and that in time to come they would all look back with satisfaction and pride at the loyalty displayed by the tramwaymen of the country in this great and historic war.

The raising of such a large army as they were now proud to know existed had naturally taken from the industrial and other areas numbers of people who comprised daily passengers on the tramcars, and consequently it was not surprising to find that heavy reductions in incomes had been sustained by many tramway undertakings. In addition to these reductions of income, most of them had had to face also heavy increases in expenditure brought about by the general system of paying either full or part wages to tramwaymen who had enlisted, and he might say that this item to the present date reached the figure of £380,000 in municipal tramways alone. There had been also the further payment of war bonus, or other extra consideration to meet, in addition to the increased cost of materials.

Referring to the employment of female labour, the president added that it was interesting to know that there were throughout the country upwards of 1,700 women at the present time engaged in traffic work alone in connection with municipal tramways, and that possibly that number would be increased very materially in the near future.

A Handy Road and River Map.—The "Mex" Motor Spirit Map of the Thames, issued by the Bowring Petroleum Company, Limited, of Finsbury-court, Finsbury-pavement, E.C.—a firm associated with the Anglo-Mexican Petroleum Products Company, Limited—is an excellent little production which should not fail to secure the appreciation of motorists and river men. The map is printed in sections, covering in all some thirty-six pages, and shows in colours all roads, locks, weirs, woods and parks, towing-paths, and golf-club houses between Westminster and the source of the river—a distance of 164 miles. The booklet is obtainable from any bookseller at 1s. nett, but we understand that the Bowring Company are distributing a large portion of the first edition to users of "Mex" motor spirit.

Highway Maintenance in Belper Rural District.—During the twelve months covered by the just-issued annual report of the surveyor, Mr. Robt. C. Cordon, the nett cost of highway maintenance in the rural district of Belper was £5,010, equal to £30 18s. 6¾d. per mile—a slight reduction on the previous year. The council's steam roller consolidated 5,543 tons of stone during the period in question. The area of roadway covered was, approximately, 73,390 super. yds., showing a daily average of 367 sq. yds., with 27¾ tons of stone, each covering 11¼ yds. The cost of consolidation per ton was 13·57d. Mr. Cordon mentions that the roller (an Aveling & Porter 10-ton compound engine) has been in constant work for eighteen years, and, in addition to rolling the council's roads, has earned a sum of £889 for hire. The engine is still in good working order.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Ilford; housing and town planning—Chester-le-Street; roads and materials—Aylesbury; sewerage and sewage disposal—Ashton-under-Lyne, Bradford, Wolverhampton; water, gas and electricity—Brigg, Lowestoft, Sheffield, Wallasey.—Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Bourne U.D.C.—The Sanitary Committee report that they have secured a site for a temporary hospital, should such a building be necessary.

Doncaster T.C.—A public convenience is to be erected in North Bridge-road, at an estimated cost of £230.

Ilford U.D.C. The council have resolved that the proposed public library be not built until after the war, and that the Carnegie Trust be requested to postpone their promised grant of £6,000 towards the cost of the scheme.

Kiveton Park R.D.C.—It has been decided to build a mortuary at a cost of £100.

Maldon R.D.C.—The sanction of the Local Government Board is being asked to a scheme for the purchase of a school-house at St. Lawrence for hospital purposes.

HOUSING AND TOWN PLANNING.

Chester-le-Street R.D.C. The parish council have submitted a request that the rural council should build a number of workmen's dwellings at Birtley.

Downpatrick R.D.C.—The council have received the Local Government Board's sanction for the payment of a £10 war bonus to each of the contractors for building labourers' cottages.

Spilsby R.D.C.—The Local Government Board have advised the council to prepare a scheme for the provision of not less than six houses at Wainfleet.

Wimbledon T.C.—In the course of his recently published report on sanitary matters, the sanitary inspector, Mr. Johnson, says: "During the year house-to-house surveys were carried out at 393 houses. One of the chief outstanding facts revealed by these inspections is the total absence of any proper accommodation for the occupiers to store food. The general provision appeared to be a cupboard under the stairs in the passage or kitchen, or one improvised by means of an old box in the scullery, all without light or ventilation to the external air. It is unfortunate that the building by-laws do not permit the local authority to insist upon the provision of adequate accommodation for the storage of food. In several of my previous annual reports I called the council's attention to this matter, and as a result power to enforce the provision of adequate food storage accommodation in new houses is granted by sec. 72 of the Wimbledon Corporation Act, 1914."

Wimborne R.D.C.—The medical officer of health stated recently, in the course of his official report: "Mud-walled and thatched cottages are still prevalent. Some have fallen to hand, when they are found to be hardly worth repairing. Some are still occupied by lifehold tenants, and here many are too poor to put them in thorough repair. The housing of the working classes in the district is on the whole good, but more accommodation is wanted, specially cottages with three bedrooms, rented about 2s. 6d."

ROADS AND MATERIALS.

Aberdeen T.C.—The corporation have called upon the owners to make up Riverside-road for a distance of 1,600 ft.

Aylesbury U.D.C.—It has been agreed to carry out paving works in St. Mary's-square and New-street.

Blaydon U.D.C. — The county council have sanctioned a grant not exceeding £500 for kerbing and tar-paving footpaths at Rowlands Gill.

Bradford-on-Avon U.D.C.—The surveyor, Mr. R. B. Lees, reported that he expected to be able to reduce the main road expenditure next year by £100, but that he was negotiating with the county surveyor to grant this amount each year for widening Frankleigh Top-road, to reduce the cost of maintenance on the road, otherwise the expenditure would probably rise again in a year or so. It was a difficult time to ask for improvements, but this would mean economy in maintenance. He estimated the total cost of filling in the ditch and widening the roadway from 13 ft. to 18 ft. at £460.

Bridgwater R.D.C.—The county council are being appealed to for an extra grant of £790 for main road maintenance.

Bridport T.C.—The borough surveyor, Mr. F. Cooper, has been asked to prepare a plan and estimate for the improvement of the road at West Bay.

Carmarthen C.C.—Two claims in respect of injuries alleged to have been sustained by falling on roads came before the Main Roads Committee recently. Mr. Mervyn Peel said he was afraid it was the old story of their roads being very slippery after tar-spraying. Rev. A. Fuller Mills thought this question was really becoming serious, for on every hand they had complaints of the slipperiness of the roads. The council ought to take the whole question into consideration. The roads were now made for motor cars, there was no doubt about it, and not for ordinary vehicular traffic. Mr. Barratt Evans, Llanstephan, said if chippings were laid along the worst portions of the road it would be a great improvement. Mr. Ben Evans, Pencader, said all the accidents were not due to tar-macadam. Accidents occurred before it was used.

Chippenham R.D.C.—With reference to a letter from the secretary of the Road Board, asking if the council could let them have the use of any plant, such as steam rollers, and men, if possible for two or three months, the surveyor, Mr. A. H Lapham, stated that he had replied provisionally that he would recommend his council to let them have the use of a 15-ton roller, together with a scarifier, water cart, &c., and men at, say, 45s. 6d. per day. The council decided to leave the settlement of terms to a committee.

Clown R.D.C.—The surveyor, Mr. J. T. Pears, has received instructions to prepare a scheme for street improvement at Jubilee Park

Dungannon R.D.C.—A letter was received recently from the Tyrone County Council intimating that they had resolved to have no "main roads" in the county. Mr. Harkin, J.P., said he thoroughly agreed with the resolution. He had all along opposed having "main roads," as the roads in North Tyrone were not in the order they should be. With "main roads" the cost to the South Tyrone ratepayers would be vastly greater than any benefit derived. The chairman said that with Mr. Harkin he had visited the northern portion of the county, and he was very glad that the county council had come to this decision.

Forfarshire C.C.—The road surveyor to the Arbroath District Committee has reported upon upwards of fifty corners which, in his opinion, it was necessary to have rounded off so as to be safer for fast traffic. It was stated that in some cases the landlords had expressed a willingness to give the necessary land for the improvements, and the matter was referred to the district councillors.

Hebburn U.D.C.—The deputy surveyor has received instructions to carry out repairs in High-road.

Lambeth B.C.—The council have adopted a recommendation by the Wharf and Cleansing Committee that the street sweeping gangs be reduced by thirty-seven men. The committee brought forward the recommendation entirely on the grounds of economy, and in their report expressed the opinion that it was extremely doubtful whether it would be possible to keep the main roads in even a passable condition with such a reduced staff.

Littlehampton U.D.C.—Tenders for granite, tar and other road materials were considered. Mr. Thompson pointed out that the total cost of materials alone would amount to about £940, and that if the council referred to the minutes of March last they would find that it was decided to fix the maximum expenditure on roads at £950. Mr. Tester suggested that the proposed quantities of granite should be reduced to two-thirds, and after some discussion this

was agreed upon. It was resolved to gain further information as to the cost of granite freightage before accepting any tender. The tender of the Shoreham Chemical Company at 8d. a gallon for 5,000 gallons of distilled tar was accepted.

Mansfield T.C.—The Highways Committee have been authorised to reopen negotiations with the owners of land on the south side of Newgate-lane with a view to acquiring it for a widening scheme. It is proposed to carry out private street works in Radmis-lane.

Richmond (Surrey) T.C.—Acting upon the suggestion of Mr. A. Dryland, the county surveyor, it has been decided, as a matter of "great urgency," to dress with Plascom and chippings, at a cost of about £100, an area of some 9,000 sq. yds. of the surface of Petersham-road.

Southampton T.C.—A decision has been reached to make up Empress-road under the Private Street Works Act.

Southmolton T.C.—An intimation has been received from the county council that they were prepared to increase from £790 to £1,200 their annual payment to the town council in respect of main roads. They had considered the proposal of the county surveyor to reconstruct the Southmolton to Barnstaple main roads within the borough at an extra cost of £500 for three years, but could not sanction it. The council decided to accept the £1,200 grant for the main roads, and the town clerk was instructed to express the council's disappointment at the county not granting the further sum of £500.

Torpoint U.D.C. — The surveyor, Mr. R. H. Beaumont, reports that the tar-spraying carried out had been very beneficial, and he was struck with the great demand there was for that means of ensuring the comfort of being able to have open windows for the access of fresh air, even in roads much used by fast traffic, which over the road from the ferry had been of a very exceptional character owing to the war. The road had been badly cut up in some places by the heavy traffic, but it was confidently hoped the Government would come to the aid of the county and local authorities.

Tring U.D.C.—The council have adopted a scheme for the manufacture of by-product granite by direct labour. The surveyor, Mr. S. S. Gettings, submitted details of the proposal, and said it would be possible to manufacture this material and show a considerable saving per ton, as against the present price of granite, which would amount to £50 on the quantity of material allowed for in this year's estimates. It would be necessary to construct a drying hearth and shedding at an estimated cost of £50.

Truro R.D.C.—The surveyor for the southern division, Mr. S. Gilbert, reports that he has reduced the staff of roadmen. He adds that he would have been able to show a greater reduction in his estimate were it not for the great number of cars that ran over the road every fine pleasure.

Westhampnett R.D.C. The clerk submitted a supplementary estimate of the expenses of the Highways Committee for the year ending March 31, 1916, from which it appeared that a sum of £2,361, being a portion of the amount allowed for the purchase of granite and surface flints, would not be required owing to the material being unobtainable except at prices largely in excess of the estimate approved by the council. The committee, upon consideration of the present condition of the highways, the probable traffic thereon during the ensuing winter, and the financial liabilities of the ratepayers consequent on the war, recommended that the sum of £800 be reserved for the purchase of local material for the execution of emergency repairs during the coming season, and the balance, £1,561, be deducted from the amount required to be raised by rates during the half-year ending March 31, 1916, such reduction being equivalent to a rate of 3½d. in the £ on the assessable value of the rural district.

Worksop U.D.C. A scheme is under consideration for the improvement of Highe-street.

SEWERAGE AND SEWAGE DISPOSAL.

Ashton-under-Lyne T.C. A letter has been received from the Local Government Board stating that one of their inspectors would visit Ashton to investigate the matter of borrowing powers for the works of sewage disposal, and to what extent action had been taken in the matter.

Bradford T.C.—It has been resolved to send a deputation to the Local Government Board urging the necessity of the continuation of the scheme for the conversion of privies into water-closets. It was stated that there were still 13,000 privies in Bradford.

Hailsham R.D.C.—The new outfall and sewage disposal works at Polegate were formally opened last week. The contractors for the works were Messrs. Streeter & Co.

Kenilworth U.D.C.—It has been decided to purchase a petrol-driven sewage media washer and pump at a cost of £85.

Ossett T.C.—At the town council meeting recently Mr. Oddie drew attention to a report by the sanitary inspector, Mr. Charles Firth, with respect to the insufficient sanitary accommodation and unsatisfactory yard surfaces at eight blocks of houses. He remarked that after this question had been shelved by the committee for six months the sanitary inspector had again affirmed that the condition of the properties was dangerous to health, and that instead of dealing with the matter at once the committee had decided to make an inspection of the dwellings. The sanitary inspector's report was confirmed by the medical officer, and the council should support the recommendation of those officials for improvements to be effected. Alderman G. F. Wilson described the action of the committee as a deliberate attempt to play with the question. The report of the committee to make an inspection of the dwellings was carried, but a clause was deleted proposing that the sanitary inspector should attend a conference in London.

Settle R.D.C.—Plans have been approved for drainage works at the colliery village of Ingleton.

Skipton R.D.C.—The scheme for sewerage works at Coates has been approved by the council, and forwarded to the parish council.

Spilsby R.D.C.—Directions have been given for the removal of certain defects found in the sewers.

Thorne R.D.C.—Instructions have been given for the preparation of a scheme of sewage disposal for Stainforth.

Totnes R.D.C.—A letter was received from the county council stating that they could not agree to the appointment of a highway surveyor for the duties of rating inspector, and it was decided to advertise the vacancy.

Wolverhampton T.C.—The town council have declined to accede to the requisition of the property owners to suspend the work of converting privies into water-carriage system. A subsidy of 50s. is granted to house-owners to cover the cost of the conversion, and already a loan of £10,000 has been incurred in connection with the scheme.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C. The council have agreed to increase by 20 per cent the charge for electric lighting; for power purposes the increase will be 20 per cent.

Bingley U.D.C.—It has been decided to continue the suspension of the public lighting in the district, except for a few lamps at bridges and other points.

Bootle T.C.—It was agreed on Wednesday to accept a tender amounting to £8,000 for additional machinery for the Marsh-lane electricity works, necessitated by the heavy increase in the output of electricity for industrial purposes.

Brigg R.D.C. It is proposed to take up a loan of £1,600 for a water supply for Ulceby.

Falmouth T.C.—It was reported last week that £400 had been saved during the past twelve months in the lighting of the town.

Holsworthy U.D.C. It has been agreed to light twenty-three of the sixty lamps in and around the town during the ensuing winter.

Ince U.D.C. - The council have adopted a report by the Highways and Streets Committee recommending that no lamps be lit on the four nights before and after the date of each full moon; that on other evenings alternate lamps only be lit; and that the lamps be extinguished at 11 p.m. instead of being allowed to remain lighted all night as hitherto.

Lanarkshire C.C.—A special committee of the county council have confirmed a resolution by the District Committee of the Middle Ward approving of the enlargement of the Cleland and Omoa Special Lighting District and adopting within the enlarged district the provisions contained in Sections 99 to 105, inclusive, of the Burgh Police (Scotland) Act, 1892. It was stated that the purpose of the extension was to make the lighting district coterminous with the scavenging district.

Listowel R.D.C. The question of a water supply for Duagh and Newtownards has been referred to the clerk of works.

Lowestoft T.C.—It is proposed to incur a capital outlay of £2,500 in connection with the supply of electric current to Messrs. Macmonchie Brothers' new works at Waveney-drive.

Saltash T.C.—The mayor, reporting on the visit of a deputation to the Plymouth water engineer, Mr. Howarth, respecting the water supply, said Mr. Howarth told them the only remedy was to build a reservoir at Saltash.

Sandgate U.D.C.—It has been decided to take up a loan of £750 from the Public Works Loan Board for the purposes of the water supply.

Sheffield T.C.—Negotiations are in progress with the Ministry of Munitions for a grant towards a probable outlay of £100,000 for extensions of the electricity undertaking, rendered necessary for the production of munitions.

Sowerby U.D.C.—Negotiations are proceeding with Captain Stansfeld for piping a supply of water on his land which at present runs into the main sewer. The proposal is to drain the water into the public well, from which only an inconstant supply is obtained at present.

Spalding R.D.C.—In connection with the council's Deeping water scheme it was reported that water had been tapped at a depth of 343 ft., and there was an overflow amounting to 40,000 gallons a day. It was stated that the water was of good quality, and that the needs of the neighbourhood would now be met.

Wallasey T.C.—It has been decided to instal new electricity plant, at an estimated cost of £9,000.

MISCELLANEOUS.

Hove T.C.—The council have agreed to undertake the work of planting graves at the cemetery, and have fixed a scale of fees for the purpose.

Nuneaton T.C.—A letter has been received from the Army Council expressing appreciation of the council's assistance in the raising of a fortress company of engineers, "which has added to the armed forces of the Crown the services of a fine body of men. The Army Council will watch the future career of the company with interest, and they feel assured that if sent to the Front it will maintain the high reputation of the distinguished corps of which it forms part."

Teddington U.D.C.—The council have accepted the tender of Mr. Long, an officer of their fire brigade, at £61 10s. for heating the fire station by hot water. It was the lowest of four tenders received.

CORRESPONDENCE.

Εις ἀνὴρ οὐ πανθ' ὁρᾶ
(One man does not see everything.)
—Euripides

THE BOGNOR MEETING.

To the Editor of The Surveyor.

Sir,—It is not very often I trouble you in expressing my opinions through the columns of your paper, but I consider it is very disheartening to those members who trouble to write a paper and arrange a meeting in their town to find that the gathering is not supported.

The response to the invitation to visit Bognor on Saturday has, so far, been very discouraging, many of the most prominent members being unable to be present owing to their attendance being required at a council meeting in London on the same day. I have written to the secretary of the institution and asked him if he can cancel the council meeting, which I trust he will be able to do, and I still hope to see a representative gathering at Bognor.

Any member wishing to be present should wire me at once. Yours, &c.,

Oswald A. Bridges.

Council Offices,
Bognor.
September 22, 1915.

FOR OTHER ADVERTISEMENTS
See End of Paper.

SURVEYOR'S CLERK Wanted; experience in municipal work necessary. Salary, 30s.—Apply J. E. Pickard, Municipal Offices, Pontefract. (2,726)

PERSONAL.

Mr. James Robertson has been appointed temporary burgh surveyor and inspector of Dunblane.

Mr. H. Wood, deputy city engineer of Norwich, has been gazetted to a commission in the Royal Engineers.

Mr. William McDonald, of the burgh surveyor's department, has been appointed burgh surveyor and inspector of Aberfeldy.

Mr. W. R. Robinson has been appointed surveyor and inspector of nuisances to the Seaham Harbour Urban District Council until the end of the war.

Mr. N. F. Spence, engineer and inspector to the Hartshorne and Seals Rural District Council, has been appointed borough surveyor and inspector of Marlborough.

Mr. Osmund Cattlin, Assoc.M.Inst.C.E., P.A.S.I., assistant borough surveyor of Holborn, has been gazetted Lieutenant in the 2nd London Sanitary Company, R.A.M.C. (T.).

Captain T. Salkield, M.Inst.C.E., the municipal engineer of Delhi, is probably the most versatile linguist to be found in the profession. In addition to his own tongue, he is versed in Persian, French, Hindustani and German.

Major Edward James Bridges, Staff for Royal Engineer Services, headquarters, Southern Command, Salisbury, has been promoted to Lieut.-Colonel, gazetted August 27th. Lieut.-Colonel Bridges is a brother of Mr. Oswald A. Bridges, the town surveyor of Bognor.

Mr. John Petree, who was up till about eight years ago borough surveyor of Jarrow, died recently in Scotland, we regret to state. Mr. Petree, who was eighty-three when he passed away, acted as professional adviser to the corporation after he resigned the office of borough surveyor. The funeral, which took place at Jarrow cemetery, was attended by the mayor and members of the town council.

GUARANTORS AND THE HADLEY WATER SUPPLY.

A peculiar position, the *Birmingham Post* states, has arisen in connection with the water supply to Hadley, an industrial district in Wellington Rural Council's area.

When some years ago a scheme was promoted by the Shropshire County Council and other authorities for providing East Shropshire with water, considerable opposition was offered by Hadley ratepayers on account of the charge which the district would have been called upon to bear as its contribution to the cost. The result was that the Bill was defeated. Hadley is in the Wellington Urban Council's water supply area, and several large ratepayers of Hadley arranged with the urban council to supply water to Hadley, becoming guarantors for the cost and the annual payments.

At Wellington Rural Council last week a letter was read from Colonel J. Patchett, one of the guarantors, asking that the council should take over the liability for the water supply, and thus relieve the guarantors. The guarantors, it was stated, had relieved the ratepayers of an intolerable burden.

The clerk said the Local Government Board had twice stated that they had no power to relieve the guarantors, and that the rural council could not legally intervene.

The Rev. W. B. MacNab (vicar of Hadley) said the guarantors could apply to the urban council to cut off the water supply to Hadley. The rural council could then say that Hadley was without water, and ask that they be allowed to supply the district. It was only fair that the guarantors should be relieved.

Mr. T. Crump undertook to convey this view to the guarantors.

Sanitary Inspectors' Association.—The annual conference of this body will be held in London on October 29th and 30th.

Price of Gas in Wigan.—Owing to the increased cost of coal, there has been a deficiency on the Wigan gas undertaking of £12,000, and at the meeting recently of the town council it was decided to increase the price of gas by 9d. per 1,000 cub. ft. The price is now 3s. 7d. per 1,000.

HIGHWAY AND SEWERAGE WORK IN SHEFFIELD.

CITY SURVEYOR'S REPORT.

Excluding [illegible] in the area recently taken over from the neighbouring districts, and allowances to departments of employees who have joined the Army, [illegible] since March 25, 1914 the expenditure of the Sheffield highway and sewerage [illegible] for the year ended March 31st last amounted to £201,986. The corresponding figure for the preceding year was £226,574, showing a reduction of £24,588.

During the current financial year it is anticipated that the expenditure of the department will be £100,000 below the usual average.

In his annual report, the city surveyor, Mr. W. J. Hadfield, states that the expenditure on highways during the year was £77 per [illegible] compared with £80,229 in the previous twelve months.

Although the mileage of streets repaired has increased, [illegible] and has likely to increase more rapidly than usual owing to further boundary extensions, the cost of maintenance has continued to decrease. Compared with valuable value the figures Mr. Hadfield points out, is less than it has ever been during a period of fourteen years. Highway expenditure for the current year, he adds, is not likely to exceed £85,000.

MILEAGE AND CLASSIFICATION OF STREETS.

The total mileage of streets repairable has increased during the year by about 9 miles namely, from 335 miles to 344 miles. The length of wood paving was increased by about 1 mile. About 2 miles of boulder paving were replaced by more up-to-date materials. In consequence of the war this work is practically suspended, therefore the hope expressed in last year's report that in five years the boulder paving would have almost disappeared is not likely to be realised.

Trial lengths of asphaltic roads, amounting altogether to about ½ mile, have been laid in various thoroughfares. Some of these lengths are answering very well under fairly heavy traffic, but Mr. Hadfield prefers to say nothing more until there has been a longer local experience with this class of road surface. An interesting feature about one street is that the material is laid as a carpet on the top of the old setts, a method which it is believed has so far been adopted in only one other city.

TAR-MACADAM ROADS.

During the five years ended March 25th last the length of these roads had increased from 16 to 55 miles, and in this period close upon 100,000 tons of tar-macadam had been made and laid by the corporation staff.

To [illegible] Sheffield approximately 700,000 super. yds. of roadway covered with this material, nearly all of which had been made in the corporation depots.

"Probably," Mr. Hadfield remarks, "there is nothing which has so much helped to reduce highway costs as the [illegible] of tar-macadam for the old water-bound macadam, and due acknowledgment ought to be made of the valuable assistance the city has received from the Road Board, without which these results could not have been achieved. As a definite instance, the case of the road to Lodge Moor Hospital and the Redmires Camp may be given. The whole of the traffic (mostly steam lorries) incidental to the construction of the Redmires Camp, as well as that conveying subsequent supplies, has passed over the Redmires-road. That part which was tar-macadam has withstood the whole of this extra wear and tear, in addition to the motor 'buses, which up to March 25th last had made over 50,000 journeys, with little apparent detriment, whereas the ordinary macadam roadway beyond the 'bus terminus was so cut up by the camp traffic alone that it has been necessary to reconstruct it with a tar-macadam surface at an approximate cost of £1,300 for about 1,400 lin. yds. of roadway."

TAR-SPRAYING AND DUST PREVENTION.

A table in the report shows that the area and mileage of roads which were tar-sprayed during the year is greater than ever, and the work is still proceeding. Mr. Hadfield says that not only does this process reduce the dust nuisance, but it considerably adds to the life of a road. The work is therefore being extended as far as practicable both as a matter of convenience and on grounds of economy.

ROAD BOARD SCHEMES.

The total expenditure on account of these schemes up to March 25th last was £27,214, of which £2,616 had been charged to revenue. The amount then required for their completion was £6,569, which, added to the expenditure already incurred, gives a total of £33,783. Of this amount £28,000 has been or will be received from the Road Board by way of loan or grant, leaving a balance of £5,783 already charged or to be charged against highway vote.

When the schemes were approved it was anticipated the vote would have to be charged with £3,083. The excess is accounted for, first, by the fact that the area of the work done has been considerably extended, chiefly by increasing the width of the tar-macadam roadways especially, by advances in the cost of labour and material subsequent to the preparation of the estimates. The cost of the remaining work may be still further increased, as much of it is being delayed, and prices are now uncertain. The cost over and above the amounts received from the board is being provided out of revenue year by year as the work proceeds.

PRIVATE STREET WORKS.

The expenditure on private street works during the year was £15,154, as compared with £27,871 in the previous year.

The falling off in expenditure is due to the fact that when men commenced to leave for the Army this was almost the first part of the work to suffer; in consequence of present financial restrictions, it is now at a standstill.

Mr. Hadfield states that every effort is being made to keep the cost of private street works within the standard price limit fixed some years ago by a special committee on private street works, but as costs of labour and materials continue to advance this becomes more difficult. From the time the standard price came into operation (the first allowance was made in the year 1906-7) until March 25th last contributions representing excess cost over standard price had amounted to £35,993, which is equivalent to 12 per cent upon £299,887, the total amount expended on private street works during the same period.

SEWERAGE.

This work, like private street works, immediately felt the effect of the enlistment of many of the men engaged, and this year, owing to the veto upon capital expenditure, very little can be done.

A table shows that out of 119 miles of stone or rubble sewers, known to exist in the year 1898, only about 20 miles now remain, and the city surveyor thinks it can fairly be said that, with few exceptions, the worst of them have been replaced. Some of the remainder, it appears, could not well be dealt with at present, even if funds were available, and, apart from the special conditions now prevailing, it was anticipated that by the end of the year 1916 a considerable reduction of the staff engaged on this work would be necessary. In anticipation of the unemployment which will probably have to be dealt with after the war, plans have been prepared and sanctioned for further work of this nature to the value of about £10,000.

STREET CLEANSING.

It is mentioned in the report that a motor sweeper which has been introduced has replaced six horse-sweepers at approximately the working cost of four. Another motor sweeper is now under construction.

TRAMWAYS.

The cost of tramway repairs and renewals is given as £35,986, and that of new construction as £5,705, a total of £41,691.

Although the average age of the track is greater, the cost of repairs and renewals, whether taken as a total sum, at per mile of track, or per car-mile, is less than for any of the preceding three years. This is considered to be largely due to the policy of welding the joints, not only on new tracks, but also in connection with renewals and repair work.

WORKMEN AND THE WAR.

Up to March 25th last 263 men had joined the Forces, and at the time of writing this report, August 31, 1915, the number has increased to 285 men. Of these 38 had for various reasons returned to civil life, leaving 247 still in the Army and Navy. The latter number includes 143 married men, but this is not a reflection on single men; on the contrary, almost every eligible single man under the department has enlisted or tried to enlist, and there

is scarcely one left who could pass the doctor. Besides this many other employees are acting as special constables or tramway conductors, or have been transferred to other corporation departments or to the armament works. A considerable number are also engaged on road works for the Government in other parts of the country.

MOTOR LORRIES.

Details are given in the report of the cost of running six lorries which were taken over by the War Office on the outbreak of war.

Although these were 5-ton lorries, they were never loaded to more than about 80 per cent of their full capacity, otherwise the cost per ton-mile might have been considerably reduced. This precaution, however, was taken so as to avoid undue wear and tear, and to prolong the life of the vehicles.

Leaving out of the question the three lorries last purchased, which had not needed tyre renewals, there has been sufficient experience to demonstrate that each lorry, after allowing very full depreciation, is capable of saving at least £200 per annum compared with team labour. The loss of the six lorries therefore means a loss to the department of £1,200 per annum, and at present there is no prospect of replacing these, as the whole output of lorries suitable for municipal work is requisitioned for national purposes.

"Questions," says Mr. Hadfield, "have been raised as to the adequacy of the allowance for depreciation, which was calculated on the War Office basis, allowing about six years' life. One of the best answers that can be given to such a question is the fact that No. 1 lorry, which had been in the service of the corporation four years, had run over 30,000 miles, and was valued in the books at £282 (about two-fifths of its purchase price), was quite lately doing good service, after nearly twelve months' wear and tear with the Expeditionary Force.

"Since the 5-ton lorries were transferred to the War Office a number of second-hand motor-car chassis have been purchased and adapted for the work of the department, and no doubt in another year's time these will have effected some saving on the cost of team labour. It cannot be expected, however, that they will be anything like so efficient as the lorries. Some of these second-hand chassis have been used in an experimental way and it is hoped that the experience now being gained will enable propositions to be put forward after the war for the much wider use of motor traction on corporation work."

STAFF.

Mr. Hadfield adds that the men who have joined the Forces include eight members of the office staff—namely, one district surveyor (Mr. J. Brierley), three technical assistants, and four clerks, in addition to which two assistants are engaged in the armament works, and two other vacancies in the office have not been filled. It will therefore, he points out, be seen that if the expenditure has been reduced the same may be said of the staff, and it is certain that the duties of the remaining members are as heavy, if not heavier, than in normal times.

Water Waste in Exeter. In a report covering the period from April 1, 1913, to March 31st last Mr. Thos. Moulding, M.INST.C.E., the city engineer and surveyor, states that the systematic inspection of water mains and services revealed no fewer than 7,983 leaks, for which notices were duly served. The approximate waste water over the whole area of supply amounts to over 200,000 gallons per day. Mr. Moulding says there is still a large area of the city which cannot be accurately checked, and the waste detected, for want of waste-water meters.

Sewage Disposal in Belper Rural District. — Mr. Robert C. Cordon, the surveyor to the Belper Rural District Council, states in his annual report that the scheme for sewerage and sewage disposal works for the township of Crich is at present held in abeyance. A small installation for treating the sewage from part of the parish of Denby—viz., Openwoodgate—with new sewers, was carried out during the year, at a cost of £203, and water laid on to the same area, at a cost of £107. A new filter was constructed at the Holbrook sewage disposal works, at a cost of £138, this work being carried out departmentally. Plans have been prepared for a small scheme to deal with the sewage at Smithy Houses, Denby, at an estimated cost of £250. This work will shortly be put in hand.

THE PROVISION OF HUTTED CAMPS.

GOVERNMENT AND THE APPOINTMENT OF EXPERTS.

In the House of Commons on the 16th inst. Mr. Touche asked the Under-Secretary of State for War if, in January, 1915, on its being known that men were wanted for hut work in France, the War Office were reminded of the offer of the services of the architectural profession, made through the Royal Institute of British Architects in September, 1914; how many men nominated by the institute or its president were thereupon appointed to work in France; (2) if the offer of the services of the Royal Institute of British Architects, made through the president of the institution in May, 1915, which was stated to be not taken advantage of because the greater part of the work was then finished, was supplementary to previous offers, and was submitted after hearing that many huts had been badly placed and badly built, with the hope of preventing anything of the kind in the future; (3) if a formal offer of the services of the architectural profession was received through the Royal Institute of British Architects in September, 1914; if any steps were taken by the War Office at that time to avail themselves of the services of competent men so offered; (4) if, in October, 1914, or shortly afterwards, the names of about fifty men, selected with great care as suitable for supervising certain military works then under consideration, were submitted to the War Office by or on behalf of the Royal Institute of British Architects; whether the services of any, and, if so, how many, of these skilled men were thereupon utilised; (5) if he would state the total number of men whose services have been employed by the War Office arising out of the original and subsequent offers of the Royal Institute of British Architects to supply competent men for every kind of work connected with the profession.

Replying, Mr. Tennant said: Offers were made by architects, and names of gentlemen selected by the Institute of British Architects were submitted to the War Office in November, but for the building of the large hutted camps in the British Isles and for work in France civil engineers rather than architects were needed. The huts in all cases followed typical plans prepared by the already existing technical staff at the War Office, copies being distributed to various local officers. There was consequently comparatively small scope for designing. But the local problems of

WATER SUPPLY, SEWERAGE, LIGHTING, ETC.,

which varied in every case, and were in some cases of great magnitude, were such as appertain to the engineering profession, and experts in these branches were engaged in various places to supplement the technical staff at headquarters and in various commands. About ten gentlemen who were members of the Royal Institute of British Architects were so appointed, as far as can be traced, but none of these were in the list submitted in November by the institute. As far as the quality of the hutted camps is concerned, the Army Council invited the president of the Institution of Civil Engineers to appoint a committee of inspection. This was done, and a strong voluntary committee, with the president as chairman, visited all the large camps in the early part of this year, while they were still under construction. They dealt with design, construction, materials, and adaptation to sites, though not with any purely military questions, and the views they expressed supported the action taken by the War Office generally in respect of the gigantic task with which they were confronted last year. As far as the Royal Institute of British Architects is concerned, it may be said that, having due regard to the requirements of the public service and the enormous number of offers received from other institutions and individuals, the institute received a due share of attention and of appointments.

Condition of London Tramway Routes.—Camberwell Borough Council have forwarded to the London County Council a letter which they have received from the London Master Carmen and Cartage Contractors' Association, calling attention to the serious state of the tramway routes of London, and stating that it is satisfied that the majority of the breakdowns occurring to vehicles on these routes are caused by defective lines, and asking the council, as the road authority, to bring pressure to bear upon the London County Council.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

SOUTH-EASTERN DISTRICT.

A South-Eastern District meeting will be held at Bognor to-morrow (Saturday).

PROGRAMME.

11.30 a.m.—Meet at Congregational Institute, London-road, where Mr. H. H. Gibbs, J.P., chairman of the Bognor Urban District Council, will receive the members.
Read minutes of previous meeting.
Paper on "Bognor Municipal Undertakings," by Oswald A. Bridges, M.R.SAN.I.
Discussion.

1.30 p.m.—Luncheon by the kind invitation of the chairman of the Bognor Urban District Council (Mr. H. H. Gibbs) at Normanscroft, Sylvan-way.

3 p.m. Visits to the various works (new housing scheme, new sea defence scheme, site of new sewage works, hospital, and underground convenience) described in the paper.

4 p.m. Motor charabancs leave for Arundel and Chichester.

Sunday, September 26th.

10.30 a.m.—Motor drives to Midhurst, Liphook and Hindhead.

J. L. REDFERN,
Hon. District Secretary

Gillingham.

SOCIETY OF ENGINEERS.

At a meeting of the Society of Engineers to be held at 7.30 p.m. on Monday, October 4th, at the Surveyors' Institution, Great George-street, Westminster, a paper, entitled "Law and Engineering," will be read by Mr. Sydney G. Turner, ASSOC.M.INST.C.E., barrister-at-law. The following being a synopsis:—

Introductory—Many subjects of common interest to the lawyer and the engineer. But no common meeting ground—Expert evidence—The engineer as arbitrator. The engineer and engineering contracts—Certificates—Municipal engineering and law—Problems of modern highway construction and traffic conditions—Sewerage and drainage—Private street works apportionments—Gas, water and electrical engineering—Legal aspects of all these branches of engineering work—Conclusion.

A. S. E. ACKERMANN,
Secretary

17 Victoria-street, S.W.

TOWN PLANNING INSTITUTE.

ARRANGEMENTS FOR THE 1915-16 SESSION.

A meeting of the Town Planning Institute will be held to-day (Friday) at 92 Victoria-street, Westminster, S.W. (by kind invitation of the Institution of Municipal and County Engineers), at 8 p.m., and it is hoped that this the initial meeting of the Winter Session will be well attended.

The arrangements for the session are as under:—

September 24th. Opening address. By Raymond Unwin, F.R.I.B.A. (M.), president.
"Town Planning Literature." By Patrick Abercrombie, M.A., A.R.I.B.A. (M.).

October 15th.—"The Placing, Design, and Arrangement of Railway Terminals." By James Crossland, L.R.I.B.A.

November 5th.—"Limited Owners and Town Planning." By J. S. Birkett, M.A. (L.M.).

December 10th.—"Arterial Roads in Greater London." By W. R. Davidge, F.S.I., ASSOC.M.INST.C.E. (M.).

January 14th.—"Open Spaces and Town Planning Schemes." By Lawrence W. Chubb (A.).

February 4th.—"The Town Planning Proposals of the Urban Land Report." By Seebohm Rowntree (Hon.M.).

March 10th.—"Width and Allocation of Space in Roads." By F. Longstreth Thompson, B.SC.

April 14th. "Horizontality and Verticality in the Architectural Treatment of Town Planning Schemes." By Barry Parker, F.R.I.B.A. (M.).

REINSTATEMENT OF TRENCHES.

REVISION OF CHARGES IN THE METROPOLITAN AREA.

Camberwell Borough Council recently gave notice to the Post Office, London County Council, Metropolitan Water Board, and the various gas and electric lighting companies of their intention to cancel the present schedule of prices for the reinstatement of trench openings, intimating that during the war the charges for such work would be the actual cost, and that after the war the prices must be reviewed.

At Wednesday's meeting of the council the borough engineer, Mr. Wm. Oxtoby, M.INST.C.E., reported that considerable difficulty would arise in ascertaining the actual cost of each trench, and that it would involve a large amount of clerical labour, and he therefore suggested that if a 20 per cent addition be made on the present price this would meet the present difficulties in regard to the loss to the council due to the old schedule of prices, and would represent the actual cost.

At the last meeting of the Metropolitan Water Board approval was given to the under-mentioned alterations or additions to the schedules of prices agreed to be paid in respect of the reinstatement of trenches opened by the board:—

	s.	d.	
East Ham and West Ham Corporations	5	6	per yd.
Tarmacadam	5	6	super.
New paching on 6-in. p.c.c. ...	16	6	,,
Southgate Rural District Council—			
Increase of 20 per cent. on existing prices.			
Metropolitan Borough Council of Shoreditch—			
Carriageway asphalt	14	4	,,
3-in. extra concrete	2	4	,,
Roadway asphalt on 3-in. concrete	7	11	,,
Carriageway asphalt on 6 in. concrete	4	8	,,
Foot asphalt on 6-in. extra concrete ...	9	6	,,
Tottenham Urban District Council—			
Tar-painted macadam	2	7	,,
Trinidad asphalt macadam ...	12	6	,,
Metropolitan Borough Council of St. Marylebone			
Bituminous paving and Trinidad asphalt	16	6	,,

Pudloed Cement Treatment.—We understand that a heading or number at Burnley, which was always flooded to a height of 18 in. from the floor, has been made dust dry by a Pudloed cement treatment. The engineer-in-charge reports that he is very pleased with the result.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

DISTRICT FOREMAN.—September 25th.—Deptford Borough Council. £2 per week.—Mr. A. Purkis, town clerk, Town Hall, New Cross-road, S.E.

ENGINEER AND SURVEYOR.—September 29th.—Cowes Rural District Council. £2 10s. per week.—Mr. J. Porter, clerk.

ROAD FOREMAN. September 28th.—Sevenoaks Urban District Council. £2 per week.—Mr. S. Towlson, surveyor.

SANITARY INSPECTOR.—September 30th.—Otley Urban District Council. £100—£120.—Mr. C. F. J. Atkinson, clerk.

STEAM ROAD ROLLER DRIVER.—October 4th.—Matlock Urban District Council. 30s. per week.—Mr. Joseph Turner, engineer and surveyor, Town Hall, Matlock.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

YORK. — November 30th.—Schemes under the Housing and Town Planning Act, 1909, in connection with certain areas within and without the city of York, for the corporation. Premiums, £100, £50 and £25.—Mr. F. W. Spurr, city engineer, Guildhall, York.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

EASHAM.—September 28th.—For the erection of a caretaker's cottage, for the corporation.—Mr. H. S. Harvey, borough surveyor.

NOTTINGHAM.—September 28th.—For the erection of half-rooms at isolation hospital, for the corporation. Mr. A. Dove, city architect, Guildhall.

HOLLAND (Lincs).—September 29th.—For the erection of stable, chaff-house, and general repairs to house, cottage, and farm buildings, for the county council.—Mr. E. J. A. Christie, county land agent, Sessions House, Boston.

HUNTINGDON.—September 30th.—For the erection of forty workmen's houses, for the corporation. —Borough Surveyor, Hartford-road, Huntingdon.

TAMWORTH.—September 30th.—For the erection of twenty-four cottages, for the corporation.—Mr. A. Clarson, surveyor, 21 Church-street, Tamworth.

NEATH.—October 1st.—For the erection of an isolation hospital, for the Joint Hospital Committee.—Mr. J. C. Rees, architect, Parade Chambers, Neath.

KILKENNY.—November 30th.—For the construction of a reinforced-concrete bridge, for the Kilkenny and Wexford County Council. Mr. A. M. Barden, county surveyor, Kilkenny.

Engineering: Iron and Steel.

WARRINGTON.—September 27th.—For the supply of a sectional boiler and heating pipes, for the Health Committee.—Borough Surveyor, Town Hall.

DUNDEE.—September 27th.—For the heating and ventilating of the city hall buildings, for the corporation.—Mr. J. Thomson, city architect, Municipal Offices, 91 Commercial-street, Dundee.

EDINBURGH.—September 27th.—For the supply of gas cookers, for the Gas Commissioners.—Mr. A. Masterton, engineer and manager, 15 Calton-hill, Edinburgh.

BATTERSEA.—October 2nd.—For the supply of iron bars, and tools, for three and six months, from September 30th, for the borough council. Mr. W. Marcus-Wilkins, town clerk.

LONDON.—October 5th.—For providing and fixing a heating and ventilating installation, for the county council.—Superintending Architect, Aldine House, Bedford-street, Strand, London, W.C.

SCUNTHORPE.—October 6th.—For the supply and delivery to Appleby Station of 400 lin. yds. of 9-in. cast-iron water pipes, for the urban district council. —Mr. Herbert Heap, engineer and surveyor, High-street, Scunthorpe.

Roads.

HENDON.—September 27th.—For the haulage of about 9,000 tons of clinker, for the urban district council.—Mr. S. S. Grimley, Council Offices.

GRIMSBY.—September 27th.—For making up certain passages, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor, Municipal Buildings, 170 Victoria-street, Grimsby.

ALFORD.—September 27th.—For the supply of 600 tons of broken granite, for the urban district council. —The Surveyor, Alford, Lincs.

EASTBOURNE.—September 27th.—For works of private street improvement in certain passages, for the corporation.—Mr. A. Ernest Prescott, borough surveyor.

OXFORD.—October 1st.—Offers are invited for a large quantity of 4-in. by 5-in. and 3-in. by 5-in. granite setts, removed from the tramways.—City Engineer, Town Hall, Oxford.

BRAINTREE.—October 2nd.—For steam rolling and scarifying, for the rural district council.—Mr. C. V. Bright, surveyor, London-road, Braintree.

KESTEVEN.—October 9th.—For the supply of granite, slag chippings and rejections, and gravel, for the county council. Mr. W. B. Purser, county surveyor, Grantham.

OSWALDTWISTLE.—October 9th.—For making up a road, for the urban district council.—Mr. R. N. Hunter, surveyor.

HASTINGS.—October 9th.—For the supply of 1,000 yards of best unbroken bluestone, for the rural district council.—Mr. J. Standen, district surveyor, Ivy House-lane, Ore, Hastings.

Sanitary.

BLEAN.—September 27th.—For emptying cesspools and removing house refuse, for the rural district council.—Mr. R. Miles, inspector, Eddington, near Herne Bay.

BUCKLOW.—September 29th.—For laying 330 yds. of 12-in. socketed pipe surface-water drain, and constructing manholes, for the rural district council.—Mr. R. Curtis Cordon, surveyor, Knutsford.

SUTTON-IN-ASHFIELD.—October 30th.—For alterations to existing sewage tanks, the construction of new screening chamber, settling tanks, rectangular bacteria beds, humus tank, engine-houses, office, and other incidental works, for the urban district council. —Messrs. Willcox & Raikes, 63 Temple-row, Birmingham.

Stores.

HYDE.—September 29th.—For the supply of cement, iron castings, pitch, and creosote oil, for the Stores Committee.—Borough Surveyor, Town Hall.

RAMSGATE.—September 30th.—For the supply of Portland cement, for the corporation.—Mr. T. G. Taylor, borough engineer.

Miscellaneous.

MANCHESTER.—September 27th.—For the supply of two light motor vans, for the Tramways Committee. —Mr. J. M. McElroy, general manager, Corporation Tramways, 55 Piccadilly, Manchester.

LLANDUDNO.—October 1st.—For the supply of retorts and fireclay goods, for the urban district council.—Gas Manager.

LISTOWEL.—October 7th.—For the improvement of the water supply, for the rural district council.—Mr. M. O'Connell, clerk.

Highway Maintenance in Exeter.—In the two years ended March 31st last, states Mr. Thos. Moulding, M.INST.C.E., the city engineer and surveyor, 13¾ miles of road were repaired in Exeter, the stone used amounting to 18,037 tons. During the same period 24¾ miles of roads, covering an area of 295,466 sq. yds., were tar-sprayed at a cost of £1,264. The question of adopting mechanical haulage for street watering has been under consideration, and Mr. Moulding has been asked to supply further particulars.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance. ‡ Provisionally accepted.

CHERTSEY.—For the construction of a footbridge, for the rural district council. Mr. C. G. Atkinson, surveyor:—

Monro & Co., London	£85
W. Burrows, Chobham	49
G. Allman, Addlestone	48
Warren, Parker & Co., Fyfleet	40
Herring & Son, Chertsey	38

MALDON (Essex).—For the removal of house refuse and pail-closet contents, for the rural district council.—Mr. W. Almond, surveyor:—

L. J. Camping, Southminster, £110 per year.

WELLINGTON.—For the supply of 250 tons of tarred broken rock, for the urban district council. Mr. G. Riley, surveyor:—

	s.	d.
Pen Granite Company, Horsehay, Salop (slag)	11	6
Cilmeg Granite Company, Chirk, North Wales (granite)	14	2
Arenig Granite Company, Arenig, North Wales (granite)	15	6

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

SEPTEMBER.

24. Town Planning Institute: Opening Meeting of Winter Session.
25. Institution of Municipal and County Engineers: South-Eastern District Meeting at Bognor.
29/30. Sanitary Inspectors' Association Annual Conference in London.

OCTOBER.

1. Society of Engineers.—Mr. Sydney G. Turner, ASSOC.M. INST.C.E., on "Law and Engineering." Surveyors' Institution. 7.30 p.m.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. OCTOBER 1, 1915. No. 1,237.

Minutes of Proceedings.

The Bognor Meeting.

It is probable safe to say that never in its whole history has the delightful town of Bognor [illegible] been the case during the season which is now drawing to a close. It has been said that the [illegible] the fact that the East Coast resorts have been very largely neglected owing to conditions set up by the war, and although there is no doubt a modicum of truth in this, the attractions of Bognor have been so well developed as to render its future assured. On Saturday the weather was delightful, and those who attended the meeting saw the town at its best. The attendance was well up to the average for district meetings, and it was particularly gratifying that Mr. Wakelam, the president of the [illegible], was able to be present. Mr. Oswald Bridges, the surveyor to the urban district council, read an excellent and exhaustive paper descriptive of the municipal engineering works of the town. He pointed out that the town had not attained its present popularity without the spending of large sums of money by the council in making the improvements necessary to maintain the high standard of efficiency required of a modern health resort. The town has a great natural asset in its beautiful sands, and this has been turned to the best account by the construction of a fine promenade over 1 mile in length and paved from end to end. The situation of Bognor is such as to render the sea defence works of peculiar importance, inasmuch as the high-water mark of ordinary spring tides is considerably above the general level of the district, and in this direction Mr. Bridges has met his responsibilities with complete success. He has insisted that all sea defence work should be done by direct labour and not by contract, and it has been proved that this is the correct policy. During the building of the western end of the sea wall and promenade the urban council was startled at his estimate, and decided to put the work out for tender; this was done, but the lowest tender was £1,139 above the estimate, and the work was ultimately done by Mr. Bridges for a sum well below his own estimate. The work was carried out in the winter of 1898, which was a very boisterous one, but, fortunately, no damage was done, and the gales really assisted the progress of the work by taking away a large quantity of earth that would have had to be excavated. Mr. Bridges has also designed and constructed three slipways on the sea front for access to and from the sands.

The most important sea defence work the town has undertaken for some years, however, is the widening of the promenade and the bull-nosing of a portion of the sea front from Clarence-road to the pier. The sea wall at this spot was built forty-five years ago, and had become very hollow on the face, owing to the rub of the beach and sand upon it, which had eaten into the wall to the depth of 18 in. in some places. It was therefore imperative that something should be done at once to strengthen it, and Mr. Bridges advised his council to construct an apron in front of the wall with flint-faced blocks, and tied into the old wall, and this was brought up to within 4 ft. of the top of the wall. This work was done out of the rates six years ago, and remained so until last year, when a bull-nose constructed in ferro-concrete was planted on to the apron, and tied into the old wall in every conceivable way. This gave 3 ft. 6 in. in width to the promenade, which was very much needed, and upon the bull-nose was fixed a heavy galvanised hand rail and standards, which have been a blessing during the enforced darkness of war time. For the rest, it may be said that the paper indicated the variety of work for which the surveyor to the council of a popular seaside resort is responsible. Mr. Bridges has achieved great success in improving the town and rendering it more attractive to visitors, and the high tributes that were paid to his work by the chairman of the council and those who took part in the discussion were well merited.

*

Temperature Changes in Concrete.

In the annual review of water supply, which appeared in these pages at the beginning of the year, reference will be found to certain observations that were being made at Kensico Dam, at Valhalla, New York, a part of the new Catskill water system. These observations have for their object the investigation of changes which take place in concrete which are

believed to be due to temperature. Special instruments, consisting of two coils of fine wire of two metals, having different temperature coefficients of electrical resistance, connected to a circuit with batteries and a galvanometer are used. The wires are of such a size and length that a small temperature change will cause a measurable change in electrical resistance which will be indicated by the galvanometer or which may be detected by a telephone. These instruments are embedded in the massing as the work proceeds. By the use of these thermometers it is possible to tell the temperature of the concrete in the middle or in any part of the structure after completion, and a record of the temperature is now being kept, the first reports of which are now coming to hand.

Interesting reference is made to the Kensico Dam observations in the recently published volume of the "Proceedings" of the American Society of Civil Engineers. The investigations are as yet incomplete, but we are told that records covering a period of seven months are now available for study. In a discussion following the reading of a paper on similar investigations made at the Arrowrock Dam, it was stated that it was the practice in that case generally to place the thermometers in concrete which had already partly set and which had been exposed for a long enough period to lose, by radiation into the air, a portion of its heat; also the thermometers were covered to a slight depth relatively in many cases, permitting radiation to go on. At Kensico Dam, on the other hand, the thermometers were placed in the plastic concrete the moment it was laid, and were buried as deeply and as rapidly as possible. In the Kensico experiments it appears that if the initial heat acquired in setting is not dissipated through a slight amount of cover the rise in temperature is constant for a given concrete irrespective of the season of placing. When the concrete was mixed a rise of temperature of 40 deg. occurred, resulting in the summer to a temperature of well over 100 deg., but the maximum temperature is not reached till long after the concrete has attained its final size and shape—that is to say for several months. It was further stated that it is too early to draw any conclusions as to variations in temperature in the concrete due to seasonal changes, for the reason that even at the present time most of the thermometers are still influenced by heat developed by the setting of the cement, some of the thermometers having been placed eighteen months ago. The heat development suggests in the first place that the increase in size which results from the heating is sufficient to develop disruptive strains in the new work. However, no surface cracks which would support this idea have yet been observed.

Further information with regard to these important investigations will be of great interest to all civil engineers. The cracks which appear in concrete and which become evident as the masonry cools are clearly due to contraction. Whether the taking of temperatures of concrete will lead to the discovery of facts which will help the engineer materially remains to be seen, but the efforts now being made by American engineers to grapple with the problem are deserving of the highest commendation, and it is to be hoped that engineers in this country will not be behindhand in assisting in the useful work. That much useful experimental work is done which is never reported publicly is evident, and in this better publication of results of investigations the American engineers certainly appear to display a more generous spirit.

* * *

Motors for Municipal Work.

The inroads which have been made by the military authorities upon the studs of local authorities have raised in a very acute form the question of the substitution for horses of some means of mechanical propulsion. The conclusion arrived at by more than one investigator is that the petrol-driven motor is economical only for work which entails long-distance haulage with comparatively few stoppages. The matter has recently been investigated by the efficiency division of the Chicago Civil Service Commission, with special reference to the conveyance of refuse from the several parts of the city to the destructor. The general conclusion arrived at is that the use of motor trucks is only warranted for hauling after the work of collection has been done by horse-drawn carts. The report states that in the investigation it has been found that either the petrol or the electric power truck can handle the hauling of refuse with comparative ease. The more economical truck has been found to be the electric. This is in large measure due to the low rate of cost of electrical energy from the sanitary district to the city for night power, and to the fact that the collected data on the electric truck have shown lower percentage rates for depreciation, maintenance, repairs and insurance than for the petrol truck.

The advantages of motor trucks over horse-drawn vehicles are stated to be: (*a*) Improved personnel of drivers, as they would be placed under civil service and would be subject to discharge for inefficiency; (*b*) more rapid transit of refuse from the different districts to the reduction plant or loading station, thereby causing less nuisance to the public; (*c*) elimination of the necessity of holding partly filled tanks in alleys; and (*d*) greater mileage per day. In comparing the costs of the two kinds of power trucks the investigators recognised that either motive power is capable of giving full service, but the factor determining the most efficient truck is measured by the cost per ton-mile for operation. The investigation appears to have been of a very thorough character, and it is satisfactory to note that the general result confirms the opinions of municipal engineers in this country.

* * *

A Monaghan Appointment.

Loose thinking, coupled with a conception of public duty which does not exclude the exercise of sympathetic interest for one's friend, would seem to be responsible for some of the inappropriate—to make use of a mild term—appointments made by local authorities in Ireland. Recently the Local Government Board has had to refuse sanction to the appointment of an official by the Monaghan Rural District Council under circumstances that would appear to offer no excuse for the action of the councillors. An architect or engineer under the Labourers' Act was advertised for, and in the result Mr. Hugh McCague, a mason, was appointed. The chief ground for this selection was that in the view of the majority Mr. McCague was a practical man. It is, of course, satisfactory to get this information, though we are constrained to suggest that he would have been a singular mason had he not been a practical man. As an excuse for the council it was argued that, while the advertisement was addressed to engineers, the word has a different significance in the country than in the cities. The real description of the person actually required, it was suggested, is one with knowledge and experience to superintend the class of work specified, which may be set out as the every-day work of a district council. But this, far from improving things, only makes them worse, and, to say the least, it is a muddle-headed way of looking at the matter which, if it may excuse the action of muddle-headed people, cannot justify the appointment of a mason to perform the duties of an architect or engineer. As the *Irish Builder and Engineer*, from which we cull these facts, points out, to advertise for an architect or engineer and appoint to that office a clerk of works or a

"handy man" stultifies the public body making the appointment, and inflicts injury on the two professions of architect and engineering without benefiting anybody, unless perhaps indirectly the man appointed, who, by virtue of being designated what he is not, often creeps into work that ought to belong to qualified professional men. This is a view that may not make a strong appeal to the members of the Monaghan Rural District Council, but it is a view, nevertheless, which it is to be hoped will be driven home to their minds by the caveat of the Local Government Board.

Rainfall in 1914.

The annual record issued by the British Rainfall Organisation is always an interesting volume, and that lately published forms no exception to the rule. Those who experienced the severe thunderstorm of Sunday, June 14, 1914, which developed with extraordinary intensity in the south-west of London, will be specially interested in the detailed accounts which are given of the happenings on that memorable afternoon, when several fatal accidents were caused by the lightning. The storm was remarkable, even among summer thunderstorms, for the narrowness of the tract where its effects were produced, and the observers were much impressed by watching from the slopes of the Chilterns, east of High Wycombe, the dense blackness of the clouds lying over the Thames Valley, although no rain was falling in that locality and the day passed without a shower. In the area principally affected the general rainfall amounted to nearly 3¼ in. The second part of the book deals generally with the rainfall and meteorology of the year under review, and includes statistics of the distribution of rainfall, together with particulars of periods of drought, rain spells, and other matters of interest. The autumn period of rain spells marked the opening stages of one of the wettest winters experienced in the British Isles during at least half a century, and the excessive rains of this period will long be remembered on account of the consequent sufferings of our overseas forces. The final part of this interesting and exhaustive record is as usual devoted to a general table of the rainfall at the several stations, between 5,000 and 6,000 in number, at which observations are taken. Mr. Hugh Robert Mill, the director, and those who assist him, are to be congratulated on the quiet and efficient performance during another year of an important public service.

Technical Education.

In view of the efforts now being made by the nation to open up new fields of industry, the expansion of the work of technical education is more than ever necessary at the present time. We have already drawn attention to the arrangements that have been made at some of the larger schools and colleges, and this week further syllabuses have been sent to us. The work at the London County Council Westminster Technical Institute, Vincent-square, began last Monday, and excellent evening courses are obtainable at very moderate fees in all subjects connected with the professions of civil engineering, heating and ventilating engineering, gas engineering, and architecture. The Northampton Polytechnic Institute announce the usual day and evening courses in civil, mechanical and electrical engineering, the most useful classes for the aspirant in municipal engineering being those in structural engineering and surveying. The Manchester Municipal School of Technology provides a number of excellent part-time courses in municipal and sanitary engineering, architecture and building, designed specially for evening students and others whose ordinary employment or avocation occupies the greater part of their time. The instruction throughout the part-time classes is given in such a manner as to show the application of scientific principles to the daily work of the students. But it cannot be too strongly impressed on the minds of intending students that their success in the later years of these courses, when their studies will bear most directly upon their daily work, will depend upon their possessing a sound knowledge of mathematics, mechanics, physics, and chemistry, and, in the case of engineering students, upon their skill in drawing; and that the sustained effort required in the first and second years for the successful study of these fundamental subjects, the practical application of which is not at once obvious, will do much to develop character. And character, even more than knowledge or skill, will always be essential to one who is to fill a high position.

* * *

A Village Water Supply.

The condition of the water supply in the village of Castle Hedingham was under discussion at the last meeting of the Halstead, Essex, Rural District Council. It appears that since the previous meeting samples of water from the six public wells had been taken and analysed, and that the reports showed that in almost all cases the water was very unsatisfactory, being more or less contaminated with organic matter, and not safe for drinking. In the meantime, it is not surprising to learn, the medical officer had on his own responsibility closed three of the wells that were said to be the worst. After considerable discussion the council resolved to reopen all the wells except one, in order that the inhabitants might have the use of the water for washing, and to affix notices to the pumps warning people that the water was not fit to be used for drinking purposes. Instructions were at the same time given to the surveyor to procure a water-cart and supply the wants of the people with pure water from other sources, and make a charge of a halfpenny per pail for it. It is only to be hoped that the warning notices will not be disregarded by the inhabitants of Castle Hedingham. In times like the present impure water supplies are not merely a local but a national danger, and it is the clear duty of the Halstead Council to take immediate steps to provide for the village a supply of water free from even a suspicion of contamination.

* * *

Beautifying Sewage Works.

We have before us a photograph which shows what can be done, at an almost infinitesimal outlay, in rendering sewage works less unsightly—a matter which in the past has frequently engaged the attention of those in charge of these usually wholly unattractive but very necessary installations. The photograph in question illustrates what has been done at the sewage works of an American town—Harrison, New York—where the sprinkling filters have been ornamented with plantings at the intersections of the fixed sprays. The disposal works, even when the sprays are not in action, is described as sightly, but when the sprays are in operation, as was the case when the photograph was taken, the effect is very attractive. Two 2-ft. lengths of 6-in. vitrified pipe, filled with earth, are embedded in the broken stone of the filter, and the moisture from the sprays and in the stone produces thriving plants. In designing the pumping station a slightly greater expense than was required by the stern necessities of the case was incurred by adding a little cut-stone trimming. The effect of the plants on the general appearance of the works is so altogether pleasing that the slight additional expenditure involved is not likely to be regretted by authorities in this country who may think it worth while to follow the excellent example set at Harrison.

Temporary Buildings for Military Purposes.

2.—HUTMENTS.

By G. BERTRAM HARTFREE, L. L. Surveyor to the Alton, Hants, Urban District Council.

The common type of barrack is of simple form and devoid of architectural features, the standard design being an oblong room. Small huts have a door at one end and windows in the other and in the sides. Large huts are provided with doors to each end, and an ample number of windows in the sides. The essential point is a weather-tight building, well lighted, and sufficiently ventilated without draughts.

Although often the practice, it is not advisable to enter the wooden posts in the ground; these should be framed to plates resting on walls or piers. When the floors are tongued and grooved the latter is far preferable, and in the absence of special local conditions should always be adopted to prevent harbourage for rats and other vermin. Special care should be taken with floors, as it must be borne in mind that blankets and sheets are ofttimes the only form of bedding provided for the occupants. Single abutting board [illegible] objectionable, and double boarding, although better, leaves room for improvement. With transverse joists the lower boards are laid longitudinally, and were it possible to lay the [illegible] direction and to break joint, a good floor would be obtained; [illegible] of wood, a floor laid in this [illegible] become dangerous. Consequently, double flooring can [illegible] boarding, which, in the absence of tongued boards, would still leave small draught holes. The most suitable boards are those with tongues and grooves, or grooves fitted with iron tongues.

Fig. 2.—Weather Boarding.

Among bad points in hut building may be named the practice of constructing the carcase without sufficient mortised mortises [illegible] plates and [illegible] spikes. All posts should have suitable tenons neatly morticed into plates and securely pinned. Studs not exceeding three in number when fixed 14 in. centres to centre may have stub tenons, but at intervals not greater than 4 ft. These should be entirely "through" tenoned and pinned, and the plates at angle intersection should be halved, with the corner posts tenoned through both halves wherever practicable. The amount of bad workmanship found in these constructions is regrettable, and although wages are fairly high, many inferior workmen are employed. Greater economy could be effected, and result in better class work, were higher wages paid to the skilled mechanics on the works and intelligent labourers engaged as "mates" to perform the work at present done by incompetent men.

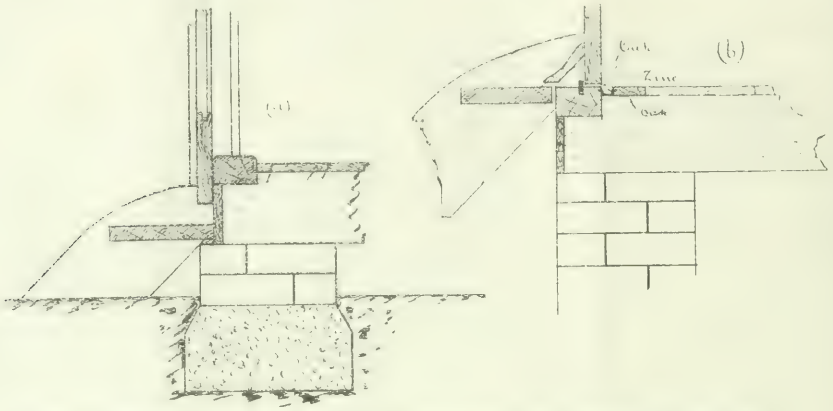


Fig. 1.—Alternative Arrangements for Preventing Rain Flooding under Doors.

In ordinary hut construction, insufficient attention is paid to the prevention of water driving under external doors. Two important points apparently are overlooked—(1) The hut is generally the men's day-room, and is always their sleeping-room. (2) The building being of the plainest form, there are no projections on plan, nor porches, to shelter the doors. During inclement weather it is common to find pools of water on the floors, and to prevent this, without altering the planning or providing a porch, I suggest either of the arrangements illustrated in Fig. 1. Fig. 1a, showing door opening outwards, requires no special comment other than the necessity when steps exist to allow sufficient clearance for the door between the strings of steps. It is desirable that the door should be fitted so as to allow its bottom rail to come at least 4 in. below the top of sill.

Fig. 1b shows the only [illegible] alternative, which requires the provision of a weather board and an iron bar; in addition, a small trough must be provided to intercept any water that may pass. The trough is formed by leaving a space of 1 in. between the sill and the first floor board. It is desirable that both the sill and this board should be oak in order to reduce the possibility of edges treading down. The trough should consist of a strip of zinc with edges up-turned and dressed in grooves in woodwork. Drainage holes should be provided, and if there is any objection to draughts through these, compo pipes may be attached and bent well below floor level to form water traps in order to stop draught.

If the exterior be covered with wood, weather-boarding is generally used. Fig. 2 shows three types of boards; at the top, the plain lap. A better joint is made by using the rebated lap, the latter being occasionally provided with Scotia moulding on the outer edge. To permit the natural shrinking of boards without splitting it is imperative that they should be [illegible] in lower thick edge only, and so

securing the upper thin edge of the boards below. Pitch pine and hatch woods are very liable to split when fixed to a plain edge, and for secure work the laps should be tarred before nailing.

Felt is commonly used for the external covering of huts, but an effective finish the joints would have to be covered by battens or tongued boarding with close joints, and the felt fixed horizontally with sufficient lap. Vertical joins are better avoided. The finished work requires careful tarring and sanding. A [illegible] recommends the use of either of the substitutes for slates and tiles of asbestos and similar substance sold under various proprietary names. Ruberoid and similar materials are equally suitable.

The internal lining is either match-board or one of the various asbestos sheetings obtained from the many firms supplying these goods. The former, especially when huts are constructed hurriedly, has the disadvantage of wood shrinkage, causing open joints that lead to unpleasant draughts. The latter has a disadvantage—more common to hard and brittle varieties—that a sudden blow (the butt end of a rifle, for instance) will probably cause a series of cracks, ruining a sheet of 18 to 20 super. ft. For an effective finish asbestos sheeting, fixed on the face of the match-boarding can be recommended, and when [illegible] must be protected the interior lined by

by permanent joints with cleats affixed to support purlins; the tie beams rest under the roof plate, and when erected they are securely bolted, and further secured, if required, by two posts in carcase framing, fixed about 3 in. apart, with tie beam between and bolted thus. The roof is further finished by a capping, which should be secured by suitable round-headed screws supplied with lead washers. All temporary joints should be secured by bolts, coach screws or stout screws, and it is very important that these be well greased before insertion to facilitate easy removal.

Too little attention appears to be paid to tarring the roofs. In addition to careless application, the tar is not brought to the right temperature before use. I have had no opportunity of trying the experiment, but believe the small size road sprayers would be found the most effective plant for this work.

REINFORCED-CONCRETE PIPES.

The city engineer of Port Elizabeth, Mr. A. S. Butterworth, will be pleased if makers of plant for the manufacture of reinforced-concrete pipes will

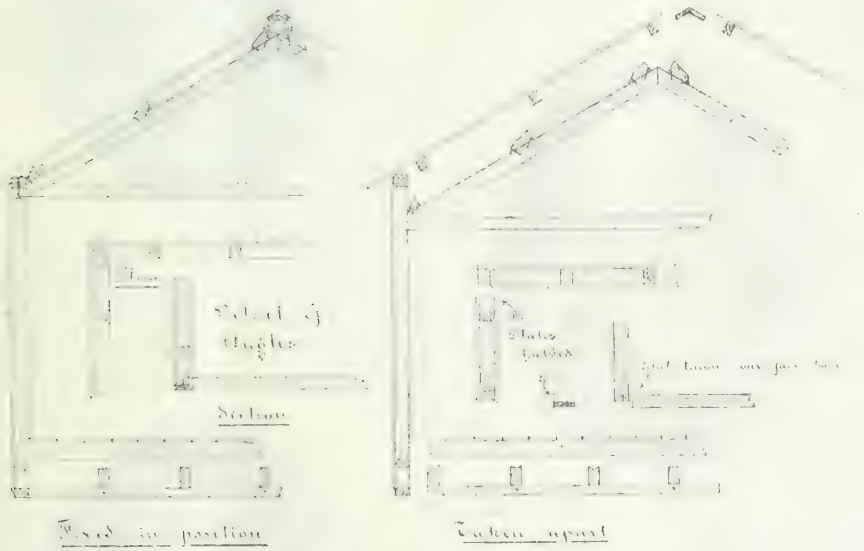


Fig. 3.—Hut in Section for Easy Removal.

will be found sound and effective.

Fig. 3 shows a useful type of hut that may be easily taken apart in sections for removal. It consists of the following parts: Sides, ends, floor, roof in two sections, roof capping and roof principals. The sides consist of stout timbers with 4-in. by 3-in. posts, 4-in. by 3-in. base plates, and floor plates and roof plates of the same dimensions. The exterior is feather-boarded, the boards being fixed horizontally; this method is preferable to vertical fixing, as the former holds and braces the carcase when apart in sections. The window and door frames are permanently fixed in their sections. Those at the ends contain gables and gable rafters, and one at least contains frame for door. In a large building both ends would have doors, the other end of smaller hut being provided with a window. A floor plate is not required in the end structures. The base plate should be well tarred on the underside and both edges. The floor boards should be fixed securely to stout joists that rest on the floor plates; boards and joists should be removable complete in small huts, or in large sections in bigger buildings. The roof consists of suitable purlins; to each 1-in. match-boarding is [illegible] vertically, and the whole covered with felt which should be well tarred and sanded. At intervals, according to the size of the building, roof principals must be provided. These should be fixed together

communicate particulars to him, c/o Messrs. Davis & Soper, Limited, 54 St. Mary-axe, E.C.

Mr. Butterworth is anticipating an early visit to England in connection with the immediate execution of the scheme, estimated to cost about £500,000, for the completion of the sewerage of Port Elizabeth.

If engineers who have now had experience over a number of years of the wearing properties of concrete pipes would be good enough to communicate with him, Mr. Butterworth would be pleased to have the privilege while on this side of calling upon them.

Retrenchment in Public Departments. In the House of Commons last week the Chancellor of the Exchequer was asked, in view of the promise of the Government that economies would be rigidly enforced, what actual reductions had now been made, or were forthwith to be made, in the expenditure of the various Government departments. Mr. McKenna, in reply, pointed out that the Retrenchment Committee had published an interim report making certain recommendations which would, he trusted, be carried into effect at an early date. The committee were examining in detail the expenditure of each department, with a view to the introduction of every possible economy, and proposed in due course to issue a further report.

Institution of Municipal and County Engineers.

SOUTH-EASTERN DISTRICT MEETING AT BOGNOR.

Mr. A. Dryland, the district chairman, presided at last Saturday's South-Eastern District Meeting of the Institution of Municipal and County Engineers at Bognor. The institution council—who met in London on the same day—were represented by the president, Mr. H. T. Wakelam, and members of neighbouring towns were present in fair force. The weather was ideal, and the visits which followed the business proceedings took place under the very best conditions. The meeting opened in the Congregational Institute shortly before midday, and when the chairman of the urban district council, Mr. H. H. Gibbs, J.P., rose to welcome the members the attendance included Messrs. C. J. Atkinson (Chertsey Rural), H. W. Bowen (West Sussex), W. L. Bradley (Tonbridge), Oswald A. Bridges (Bognor), A. J. Catt (Shoreham Harbour), H. T. Chapman (Maidstone), Robert Chart (Coulsdon and Purley), W. A. Clegg (Dorking), Richard Collins (Enfield), A. Dryland (Surrey County, district chairman), A. G. Gibbs (Midhurst), T. Grove (Surrey County), R. J. Jenkins (Portsmouth), Ernest R. Lewis (Cranbrook), F. J. Lobley (Chichester), B. A. Miller (Seaford), T. A. F. Phillips (West Sussex), John L.

Mr. Oswald A. Bridges, M.R.San.I., M.I.C.E., F.I.S.A.
Engineer and Surveyor to the Bognor Urban District Council.

Mr. Oswald A. Bridges, who for nearly twenty years has been the engineer and surveyor to the Bognor Urban District Council, has seen the town double in population during his tenure of office. Previously he was for two years and seven months borough engineer and surveyor of Lymington, Hants, to which position he was appointed from the War Department, under which he was engaged in assisting in the preparation of the plans for the reconstruction of the barracks at Parkhurst, in the Isle of Wight, under his brother, now Lieut.-Colonel Bridges, A.R.I.B.A. The work, which cost £84,000, also entailed a sewerage scheme in which the drainage from Parkhurst prison joined.

Redfern (Gillingham, hon. district secretary), F. Roberts (Worthing), H. H. Scott (Hove), C. Chambers Smith (Westminster), Frank B. J. Stephens (Bognor), H. T. Wakelam (Middlesex, president), Arthur W. Ward (Portsmouth), G. W. Weston (Bognor), and F. Wilkinson (Deptford), members; T. Bailey, L. Booth (Bognor), L. Boyce (Bognor), O. L. Bridges (Bognor), Arthur Collins, T. S. Farrar (Frinton), H. H. Gibbs Thos. Hart, P. Hayward, H. Howard, H. Lovell, Marlow Read (Middlesex County Council), I. Tubb and A. J. Tyler (Croydon), visitors. Letters of regret for non-attendance were received from Messrs. E. A. Borg (Margate), J. H. Brierley (Richmond), F. T. Clayton (Reigate), John S. Crawshaw (Weybridge), G. E. Crowter (Godstone), E. J. Elford (Southend), F. Harris (Tonbridge), E. Young Harrison (Guildford), T. W. A. Hayward (Battersea) and Chas. W. Leney (East Preston).

In the course of his remarks the Chairman of the Council observed that such meetings were of benefit not only to municipal engineers, but to the communities under their care. They were enabled to come into personal contact with each other and get ideas that helped them to solve many of the problems that confronted them. They were visiting Bognor at a time when the town was never in a more prosperous condition, but they had had their dark days, and had had trouble, in particular, with their sea defences. Mr. Bridges, their surveyor, had, however, gradually improved these since he

Mr. H. H. Gibbs, J.P.
Chairman of the Bognor Urban District Council.

came to them twenty years ago, and when they had seen what he had accomplished in that connection they would come to the conclusion that he was a very good officer. But for what he had done the town would not be what it was at present.

In moving a vote of thanks to Mr. Gibbs, Mr. Dryland remarked that every possible arrangement

Mr. Joseph Jubb.
Solicitor and Clerk to the Bognor Urban District Council.

had been made for their reception, and Mr. Bridges had written for them a paper covering a wide range of municipal work. They would all find in that something to interest them, and they would be glad to go round afterwards and see the works as executed. It was gratifying to hear Mr. Gibbs' appreciation of the services rendered to the town by Mr. Bridges. It was not every town that appreciated its officers, although recognition of that kind was more general than it used to be. Perhaps it was because the officers had improved.

[illegible] vote of thanks was carried, and the meeting then proceeded to the discussion of Mr. Bridges' paper.

BOGNOR MUNICIPAL UNDERTAKINGS

[illegible] we reproduce elsewhere in this issue.

DISCUSSION OF MR. BRIDGES' PAPER

Mr. A. Dryland Stone remarked that, in view of the number of meetings which was being held that day in London, they were fortunate in having among them the president, Mr. Wakelam, and he was sure all would join in a hearty vote of thanks for attending. The paper was a very comprehensive one, and showed the very great variety of the work that had to be carried out in a seaside town. Such work called for a very great variety of engineering talent, and having read carefully through the paper he was sure they could congratulate Mr. Bridges on the way he had met all emergencies that had cropped up. In his younger days he was interested in sea defence work himself, and he had been particularly struck by the bull-nose on the sea wall at Bognor, and would like to know what effect it had on the gathering of the beach. It occurred to him that it might possibly cause a scour at the foot of the wall by the waves being thrown back. Mr. Bridges had made use of clinkers in connection with road work, but he should be glad to know in what particular way he had employed them. They had been successfully used at many seaside places for tar-macadam. He desired personally to thank Mr. Bridges for the trouble he had taken in preparing the paper, and for making it possible for them to have the meeting there that day. There was always plenty to occupy a surveyor, and not less so at the present moment, and to give up his time as he had done was a great sacrifice on his part.

The President (Mr. H. T. Wakelam) said he had first of all to acknowledge Mr. Dryland's kind words with reference to himself. He came there that day because he thought he would be doing more for the institution generally than by attending the council meeting. His view was that presidents should always be among the members whenever meetings were being held; one was able better to judge what was going on. He was glad to hear what Mr. Dryland had said with regard to Bognor. He had had the pleasure of knowing Mr. Bridges since the latter was a small boy, and his brother, Lieut.-Col. Bridges, for more than thirty years. But for the war there would have been a much larger attendance of members, many of whom were serving their country in various capacities. He desired to thank the chairman and members of the council for the facilities they had granted, and could assure them they would [illegible] with happy recollections of their visit.

Mr. J. L. Redfern (Gillingham) also expressed appreciation of the paper, which showed what a variety of work had to be done by a municipal engineer. It was not necessary always to spend very large sums of money, but it required as much intelligence to spend small sums economically as to handle big ones, and the efforts and care demanded of the surveyor of a town like Bognor were very great. It was surprising that in a town of 9,000 inhabitants it was possible to have the population increased for a part of the year to 35,000; it must make a great demand on the sanitary arrangements of any town. He was interested in the housing work that had been done, and would like to know whether the rents—which appeared to be very low—paid the interest and principal, or whether there was any loss. The accommodation seemed to be very good, for the rents charged were exclusive of rates. There were two types of cottages; some had a sitting-room and some had none, and he would like to know whether one type let as well as the other. Mr. Bridges emphasised the fact that the flooring was rebated. Was it actually rebated, or only nailed and tongued? He noticed also the town had public lavatories both above and under ground. He should like to know Mr. Bridges' experience of the two, and did he not think public lavatories should be above rather than under ground? It seemed to him that the latter type were disappearing. The town had changed over from the 1875 Act to the 1892 Act. Did the latter work more easily? In Gillingham they still worked on the older Act, and had had no trouble with it.

Mr. A. W. Ward (Portsmouth) said he desired to congratulate the council on the healthy and clean appearance of the town. At a time like the present, when labour and materials were so difficult to obtain, it was an apparent proof that the town was being well looked after. The victories gained in making and improving towns were greater than those obtained in destroying towns. Mr. Bridges had shown a remarkable all-round knowledge. He had done a great deal of his work by direct labour, and in some cases had been able to do it at a price actually below that which would have been charged by a private individual—which was proof of the supervision and care of details that was not found every day. He noticed in Bognor that a considerable amount of brick had been used for gutters, and would like to know what was the life of the material. It certainly had a nice appearance, and if it would stand up and gave economical results it was quite a good thing. Also, what was the cost of refuse destruction per load, and what was done with the steam produced? At the same time he would like to know whether any trouble had been experienced with the expansion of the cement along the front. They had quite a lot of difficulty in that connection at Portsmouth; they had had paving blow up and frighten people. There were no signs of anything of that kind at Bognor, and yet he had noticed no expansion joints.

Mr. H. W. Bowen (West Sussex) remarked that the clear way in which every detail had been put in the paper left him no room for criticism. They had been told that no main roads existed in the town. That was his loss, because there was no town that he would visit in preference to Bognor. He had had the pleasure of knowing the town and Mr. Bridges for nearly twenty years, and had formed the very highest opinions of the latter's abilities as an engineer. He had adapted his knowledge to the growth of the town, and he was sure that the recent improvement which he had made to the promenade, in particular, was such that no one could fail to appreciate it. Bognor, added Mr. Bowen, was an ideal town for visitors.

Mr. A. J. Catt (Shoreham Harbour) observed that it was just as difficult for him to pick a hole in Mr. Bridges' sea defence work as it was for the sea to make an impression upon it. He was pleased to see that Mr. Bridges had proved by personal experience that he could carry on his work by direct labour. That was a great advantage. It had been his own experience in carrying out piers and sea defence works at Shoreham Harbour. The engineer on the spot knew all the local conditions, whereas the contractor did not generally possess that knowledge. He therefore allowed for "contingencies" which were not likely to arise, and his estimate was increased accordingly. He had been able to carry out his work by direct labour more economically than by contract. As to the groynes, did Mr. Bridges find that the angle he had adopted had been successful?

Mr. F. Roberts (Worthing) said there was much difference of opinion on the last-mentioned point. The right-angle groynes there might not appear to have collected much beach, but of late weeks an east wind had been blowing, and that had scoured all the beach away from the west side of the groynes.

Mr. H. T. Chapman (Kent) said he had the pleasure of living in Bognor from 1892 to 1895, and could realise the vast improvements—especially in connection with sea defence work—that had since been carried out. He found the place had been wonderfully improved. One thing which had struck him had been the considerable reduction which Mr. Bridges had effected in the crossfall of the promenade at the west end. Previously this was most uncomfortable for pedestrians. The tar-paving at that point was also a great improvement. The fencing which had been erected along the promenade must also have had the effect of preventing accidents. He thought the town and its officials were to be congratulated on the improvements which had been carried out in recent years.

Mr. F. Wilkinson (Deptford) congratulated Mr. Bridges on the houses he had built for the working class; these seemed to be very good indeed. They were much cheaper than anything they had been able to build at Wimbledon, and he should like to know the cost of the bricks. He believed the houses were rough-cast and half-timbered work; what was the cost of the rough cast? No costs were given in regard to highways, and he would be glad to know the cost of the chippings and the tar used, the cost per superyard of the tarring done, and that of the tarred granite, and what thickness of material was put down on the heaviest-trafficked roads.

A hearty vote of thanks was, on the proposition of

the chairman, Mr. Dryland, accorded to Mr. Bridges for his paper.

Mr. Bridges, in replying, remarked that Bognor was only a very small town, but a great amount of work had been done there during the past twenty years—work of a very varied character, which had been carried out mostly by direct labour. With regard to Mr. Dryland's questions, the bull-nose on the sea wall had not had the effect many thought it would. The local fishermen considered it would create a scour, but, as a matter of fact, when a wave hit the wall it was thrown back at least 15 ft., and did not remove the beach from the face of the wall. It had fostered rather than removed material. They were using clinker only for light road construction; there was, unfortunately, more vegetable matter in it than cinders. The clinker was very good for light-traffic roads. In regard to Mr. Redfern's question about the rents charged for the houses, they bought the land very cheaply, and got good terms for the borrowing of the money—3¼ per cent for the cottages. Eighty years were allowed for repayment in the case of the land, and sixty years for the houses. For repairs and so forth 12½ per cent was provided, and a profit of about £1 was made per house per year. As to which type of house was preferred, he could only say that both kinds were in very great demand, though he thought the one without the parlour was most sought after. They had not lost a week's rent yet. The rents charged were inclusive of rates and water. With regard to the rebated flooring, with a grooved floor they would find that the groove turned up with the heat of the sun, whereas in the rebated flooring there was nothing to curl up. Where the nature of the site permitted it, they preferred to put public lavatories above ground; but it was difficult to obtain such sites. He could not say that he had had any trouble with the 1875 Act in connection with private street works, but their inability under the Act to make a contribution when desired was, perhaps, the cause of their adopting the 1892 Act. Mr. Ward had asked a question regarding the brick channelling. He had had some in use since he first went to Bognor, and it hardly showed any signs of wear, and was such a success that he should continue to use it. They were not utilising the steam from the destructor, but as it would be necessary in connection with the sewering of a portion of the district to instal Shone's ejectors, he proposed to run the air mains to the destructor, and thus make use of it. In regard to the matter of cement expansion, he had had instances of portions of the work on the parade which had gone off like a gun, but very few. The expansion of cement was a thing that could not be prevented. The main roads question was a sore point with them. They spent a lot and got nothing for it. At one time they had a contribution of £200, but now got nothing. Regarding the question of direct labour, he thought he had fairly explained in his paper that that was to the advantage of the town; for instance, on the first big job he did here he saved the town £1,100. He had tried various angles for the groynes, but the one he had adopted was the one he considered the best. The cost of tarring was about 2d. per square yard; chippings cost 17s. 6d. per ton, and the tar-macadam 22s. 6d. The tar-painting was done by hand. The chippings—¾ in. in size—were rolled after they were put on. Distilled tar cost him 4¾d. per gallon.

The members were afterwards the guests of the chairman of the council, Mr. Gibbs, at an excellent luncheon at the Royal Norfolk Hotel. There were only two toasts, and the speeches were of the briefest. Mr. Gibbs proposed "The Institution," and Mr. Dryland, the district chairman, in replying, acknowledged in fitting terms the cordial welcome and generous hospitality that had been extended to the members. Speaking for himself, he had seen enough of Bognor to make him want to see it again.

The health of Mr. Gibbs was proposed by the President, Mr. Wakelam, who spoke of the pleasure it gave him on the occasions that he visited the town to observe the improvements that were continually going on under the superintendence of the surveyor, Mr. Bridges.

The afternoon was devoted to inspections of the isolation hospital, sea defences, refuse destructor, fire station and public lavatories. At the close of the visits the members were entertained to tea by Mr. Gibbs.

On Sunday a number of the party took part in an enjoyable motor drive to Midhurst, tea being provided on the return by Mr. Bridges at his residence.

BLACKBURN BOROUGH ENGINEERSHIP.

APPOINTMENT OF MR. ARTHUR RACE.

Mr. Arthur Race, borough engineer and surveyor of Barrow-in-Furness, has been appointed borough surveyor, engineer and water engineer to the corporation of Blackburn at a salary of £800 a year.

Mr. Race commenced his professional training in 1893 at Burnley, his native town, and subsequently served private firms at Colne and Manchester. In 1901 he became second assistant to the borough engineer and surveyor of Barrow, succeeding to the position of chief assistant in the following year, and finally being appointed borough engineer and surveyor in 1908.

During the fourteen years Mr. Race has been at Barrow considerable improvements and extensions have been effected in the main drainage system. Among other things he designed an improved movable receptacle for refuse which was adopted by the corporation. Barrow was one of the first towns to adopt petrol motors for street watering, refuse removal, and haulage, and in the matter of highway construction and maintenance the enlightened policy of Mr. Race was warmly supported by a progressive town council. Mr. Race was officially concerned, on behalf of the corporation, in the laying out of an estate of 400 acres belonging to Vickers Company, Limited, where two model villages, consisting of about 1,500 houses, have been built. This scheme included the construction of workshops, railway sidings, new streets, and the inauguration of a water supply and sewage disposal works. An important scheme completed in 1908 was the construction in connection with the development of Walney Island of a bascule opening bridge over the Walney Channel and approach roads at a cost of £152,000. Another scheme, for which Mr. Race prepared the Parliamentary plans and estimates, was an additional supply of 2,000,000 gallons of water per day from the river Duddon, which was completed in 1910 at a cost of £164,000. He has designed and supervised the carrying out of large main road improvements, and has prepared a housing scheme for the erection of 220 workmen's dwellings which is being carried out at an estimated cost of £60,000. Town planning has also engaged his attention, and he has in hand at the present time a scheme for an addition to the water supply.

Mr. Race is a member of the Institution of Municipal and County Engineers, professional associate of the Surveyors' Institution, and a member of the Society of Architects.

Motorists and the Budget. The following resolutions have been sent to the Chancellor of the Exchequer by the executive committee of the Automobile Association and Motor Union: "The committee of the Automobile Association and Motor Union, representing upwards of 100,000 users of motor vehicles, having considered the proposed increase in the petrol duties, desire to affirm the principle upon which the original petrol duties were imposed—viz., that the proceeds should be devoted to the improvements of the roads—and they invite an assurance from the Chancellor of the Exchequer to the effect that on the termination of the war this policy will be again carried out and the tax restored to its former level."

The Engineer in War. The engineer to a modern army (observes a writer in the *World's Work* for September) is confronted with many peculiar and perplexing problems. The various camps have to be laid out and organised. They are essentially small, humming towns, demanding all the conveniences and appurtenances of a community which has been established for centuries. Questions of water supply, sewerage, lighting, and so forth, have to be settled, since the health of the camp is imperative. Disease is more to be feared upon the battlefield than the bullets and projectiles of the enemy. A pure and adequate water supply is imperative, and extreme care has to be exercised in making positive that the source cannot possibly become contaminated either from the wastage of the battlefield, sewage, or deliberate hostile poisoning tactics. The clean bill of health which is being shown by the respective belligerents, with the possible exception perhaps of Austria, testifies to the skill which has been devoted to questions of water and sanitation, but the security of the fighting-men is assured by the appointment of accomplished waterworks and sanitary engineers to the various armies.

Bognor Municipal Undertakings.*

By OSWALD A. BRIDGES, M.R.SAN.I., LIC.R.I.B.A., Engineer and Surveyor to the Bognor Urban District Council.

The urban district of Bognor is one of the best-known resorts on the South Coast, and during the past twenty years it has leaped into popularity as a first-class seaside resort. To attain this proud position the urban council have spent large sums of money unstintingly in making the necessary improvements to keep the town up to a high standard of efficiency. It is admitted that Bognor has a natural asset in its beautiful sands, which are undoubtedly some of the finest in the kingdom, but to attract the visitor improvement schemes have had to be undertaken, and the local authority has not been backward in carrying them out. One of the chief features of Bognor is its fine promenade, which is over a mile in length and is paved from end to end. The surrounding country for walks and drives is charming. The fine range of the South Downs, which shelters the town from the north winds, stands out prominently as a beautiful background amidst a delightful country of hill, dale, common, forest and park. The area of the town is small, as it contains but 885 acres. The population is 9,000, but during the summer months it reaches 35,000. The rateable value is £62,200.

Cottages Let at 4s. 6d. per Week at Bognor.

The town is built upon a porous, gravelly soil, which dries quickly after rain—two facts which contribute largely to the healthiness of the district. Its climate is mild and unusually equable, and there are no extremes in temperature. The atmosphere is clear, dry and bracing, fogs being very rare. The prevailing winds are from the south and south-west, and there are few days in summer when the heat is not tempered by a fresh sea breeze. Its sunshine records are almost incomparable. In 1914 it enjoyed no fewer than 1,982 hours of bright sunshine. The death-rate in 1914 was 12·3. The town is supplied with water by the Bognor Water Company, which derives its supply from the Sussex Hills, 7 miles distant from the town. The supply is abundant and of the purest quality.

It will be seen that Bognor has many advantages, and is an ideal town for those in poor health to reside in. The urban rates are 3s. 7d. in the £, collected in two half-yearly rates.

HOUSING.

This important question of housing the working classes was under consideration by the council seventeen years ago, when they purchased sites in Ockley-road for the erection of six cottages, each containing sitting-room, kitchen, scullery, pantry, water-closet and coals on the ground floor, and three bedrooms on the first floor; but only two were erected. These are now let to the head foreman and horseman at a weekly rent of 5s. 6d. and 5s. respectively. The cost was £230 per house without the land.

Nothing further was done until 1912, when the council embarked on a scheme for the erection of forty-one cottages, of which thirteen were built in Sheepwash-lane by contract, at a cost of £2,700, and which are let at 5s. 6d. per week. They contain sitting-room, kitchen, scullery, wash-house, coals, pantry, and water-closet on the ground floor, and three bedrooms on the first floor. Twelve cottages were then built in Gravits-lane, of a smaller type, and let at 4s. 6d. per week; they contain living-room, scullery, pantry, coals and water-closet on the ground floor, and three bedrooms on the first floor. The amount granted by the Local Government Board for the erection of this block of cottages was £150 each, but the lowest tender received was £179 2s., and the council therefore decided to do the work departmentally, which was evidently the correct thing, as the work was satisfactorily carried out for less than the estimated sum. Sixteen cottages of the same type were next built in two blocks in the same road by direct labour, but, owing to the extra foundations required in difficulties met with on the site, and the war breaking out before the completion of the work, the cost rose to £160 per cottage, for which an excess loan was granted by the Local Government Board. The council were fortunate in securing the land upon which these houses have been built at the ridiculously low price of £5 10s. per plot of 15 ft., with a depth of 100 ft.

Owing to a change in the policy of the local authority, no more cottages are to be erected for a time in Gravits-lane, and other land was purchased in the Linden-avenue, which is nearer to the heart of the town; here the council were able to purchase 1,000 ft. of frontage, with an average depth of 90 ft., at 25s. per foot in a road that is sewered, kerbed, channelled and partly made up. Upon these sites a better-class dwelling is to be erected, which is estimated to cost £250 each, and to let at 7s. 6d. per week. They will principally be for the artisan class of workman, and each house will contain living-room, kitchen, scullery, pantry, coals and water-closet on the ground floor, three bedrooms and bath-room on the first floor. Four houses of this type were just about to be built when the war started, and the council had instructions to cease building operations and minimise expenditure in all directions from the Local Government Board.

This order also put a stop to another scheme to which sanction was being awaited, the plans having been before the Local Government Board and the inquiry held. It was for the purchase of a field in Sheepwash-lane for £600, containing 5¼ acres which

* Paper read at the South-Eastern District Meeting of the Institution of Municipal and County Engineers at Bognor on Saturday last.

it was proposed to lay out on the garden city style, and on it erect 107 workmen's cottages, which it has been proved are still in very great demand at a reasonable rent.

The design of all the cottages erected in recent years by the urban council have been made pleasing in appearance, and to harmonise with the rural surroundings. The buildings have 11-in. outside hollow walls, which are a necessity in this district, South Water red-faced bricks being used from the ground to first-floor level, above which is treated in imitation half-timbered work in cement. The roofs are boarded, felted, and tiled with Rosemary Broseley tiles. The chimneys and the construction of flues have had special care, and the author has not received a single complaint of smoky chimneys; nothing is worse than to live in a room continually being filled with smoke from the chimney. He has "bottle-nosed" all flues, and carried the chimneys well above the roof, and fixed louvred chimney pots on all flues, which method he has always found efficacious. Another point on which he feels very strongly is rebated flooring for the floors; it excludes all draft on the ground floor, and in the case of the first floor it prevents dust and germs finding their way in between the joists. But, above all, the ceilings below are never discoloured through a person washing the floor above, as the water cannot get through the rebated joint of the flooring. The plastering has all been done with "Serapite," which gives a very smooth surface, and takes the washable distemper very well, with which the walls are coloured. Picture rails are used, which cost but very little—something like 3s. 6d. per 100 ft.—and prevent the walls being knocked about by nails being driven in indiscriminately. A special feature is always made of the kitchen dresser, which forms a valuable piece of furniture to poor people. It has a double cupboard with two drawers above, and the top portion fitted with 1½-in. sashes to keep out the dust from the crockery-ware. The whole of the internal woodwork is finished with Matsino, coated with good varnish, which is inexpensive and will last for years. The drains are so laid that each system of a block of buildings can be efficiently flushed by the discharge of water from a water cart.

Cottages Let at 5s. 6d. per Week at Bognor

SEA DEFENCES.

The construction and maintenance of the sea defences and promenade form the principal duties of a seaside surveyor. One has ever to be on the alert and to keep a watchful eye over the works under his control lest the sea should make inroads with his defences, which usually commence in a very small way. It is much easier to carry out some small repairs than to mend a breach in a sea wall, but during nearly twenty years of office in Bognor nothing like this has ever occurred. It should be stated that the town of Bognor is a very flat one: the level of the centre of Gloucester-road on the extreme south-east of the district is only 9 ft. above ordnance datum, and in one outlying part it is only 5 ft. above ordnance datum. As high-water mark ordinary spring tide is 10·75 above ordnance datum it will be seen that, but for the town's sea defences and the sea wall built by the Felpham Level Commissioners to the east, the town and district would be liable to flooding at every spring tide. Realising the position, the urban council have spent since 1875 £23,840 in constructing new works, and the author wishes to pay a tribute to his predecessor, Mr. W. L. Barrett, for the very excellent work he did years ago. It may not be known to every member that there is no provision in the Public Health Act, 1875, for the construction of sea defence works, but the town was granted an Act of Parliament, 5 and 6 William IV., c. 101, in 1835, for the construction and maintenance of sea walls, promenade, groynes, jetties, harbour, &c., under which Act all works are undertaken. The author has insisted that all sea defence work should be done by direct labour and not by contract, and it has been proved that this is the correct policy. During the building of the western end of the sea wall and promenade the urban council was startled at the author's estimate, and therefore decided to put it out for tender; this was done, but the lowest tender was £1,139 above the estimate, and the work was ultimately done by the author well below his own estimate. The work was carried out in the winter of 1898, which was a very boisterous one, but, fortunately, no damage was done, and the gales really assisted the progress of the work by taking away a large quantity of earth that would

Bognor Isolation Hospital.

[illegible] wall was 486 ft. in length, and consisted of [illegible] the two ends being [illegible] 7 ft. 6 in. thick at the base, and reduced of 3 in. to the foot on the face. It was supported by counterforts at the back of the wall 6 ft. wide, 18 in. in thickness, and 10 ft. apart. The foundations were [illegible] ft. into the blue clay. The promenade was formed with tar-paving 2½ in. in thickness, and laid [illegible]

The retaining wall on the north side of the promenade is built with local stock bricks in cement [illegible] with flints [illegible] dressings. Seats are

Bull-nosing on Eastern Sea Front.
Showing how work was set into existing wall. Old [illegible] were also used.

formed in the wall at intervals which have been much appreciated.

The author has designed and constructed three slipways on the sea front for access to and from the sands, and these works will give the members an idea what can be done with advantage for those who have to go down to the sea in boats or otherwise. The one constructed on the east side of the pier is for the use of the fishermen and boatmen, who have always clung to that particular spot on the beach, and they preferred a slipway going south so that they could launch a boat direct into the sea at high water or half high water. The work was constructed by running two sea walls down to the foot of the beach or sand, filling in the core with chalk, and covering the [illegible] to the [illegible]

Method of Constructing Bull-nosing.
Steel moulds were bolted together and held in position by struts.

being formed in cement and trowelled smooth. Pieces of tarred V-shaped deal, with strips of oak nailed on same, are let into the concrete surface to obtain a foothold for horses using the slipway. A winch with wire ropes and blocks are provided on the east side, for letting down or hauling up bathing machines and heavy boats. This slipway has a gradient of 1 in 5, and is one of the most appreciated improvements ever carried out. It cost, with a new groyne, £507. The other two slipways and embayments constructed east and west of the pier serve two useful purposes: the slipways provide access to and from the beach and sands, and the embayment gives embellishment to the sea front and breaks up the long straight lines of the promenade. Viewed from the sands they have a very pretty appearance with their heavy bull-noses which overhang the masonry and form a fine cornice. These bull-nosed and coping blocks were made in the council's depot, and brought to the site and fixed in position by the use of shear legs and endless chain. The construction in other respects was very similar to the one already described. In all cases the foundations are taken 3 ft. into the blue clay at whatever level that is. The cost of the western embayment and slipway, opposite West-street, was £378, and that of the eastern one, opposite York-road, £450.

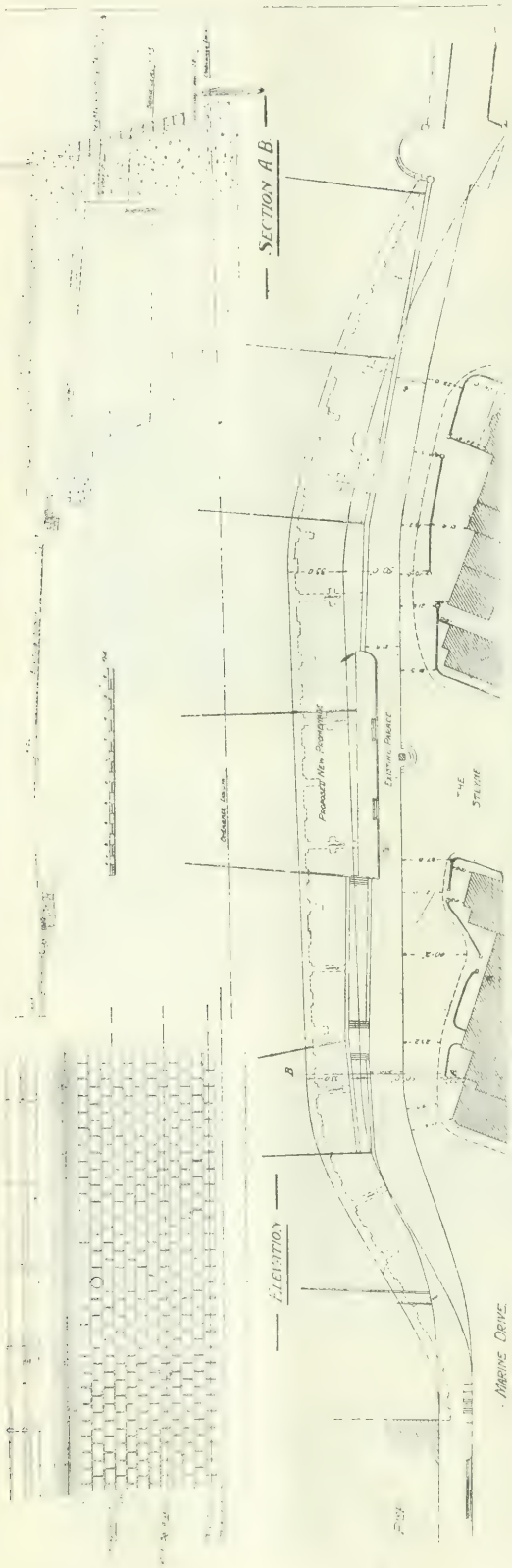
The most important sea defence work the town has undertaken for some years is the widening of the promenade and the bull-nosing of a portion of the sea front from Clarence-road to the pier. The sea wall at this spot was built forty-five years ago and had become very hollow on the face, caused by the rub of the beach and sand upon it, and had eaten into the wall to the depth of 18 in. in some places. It was therefore imperative that something should be done at once to strengthen it, and the author advised his council to construct an apron in front of the wall with flint-faced blocks, and tied into the old wall,

Bull-nosing at Bognor.
Completed work, with York-road slipway and embayment in distance.

[illegible] was brought up to within 4 ft. of the top of the wall. This work was done out of the rates six years ago, and remained so until last year, when a bull-nose constructed in ferro-concrete was planted on to the apron, and tied into the old wall in every conceivable way. This gave 3 ft. 6 in. in width to the promenade, which was very much needed, and upon the bull-nose was fixed a heavy galvanised hand rail and standards, which have been a blessing during the enforced darkness of war time. The construction of this bull-nose was carried out in the easiest possible way and very expeditiously by the employment of specially made steel sheet moulds, 3 ft. in width, and which were bolted together and

Effect of Waves on Wall.

supported from the beach by struts, and at night time, in case a gale of wind should spring up, they were secured by chains to the promenade. The concrete used in this work was very good 4 to 1, and granite chippings were used to face it. Before this work was undertaken the town used to be continually flooded and the promenade and roads strewn with beach and sand, but this seldom, if ever, occurs now. This work, including the widening of the promenade near the eastern bandstand, cost £1,983. The widening consisted of building a retaining wall



Proposed Widening of Bognor Marine Drive and Promenade, West of Pier.

on the road side and taking in two plots of grass and filling the space in between this new retaining wall and the promenade with earth, covering the surface with 2½ in. of tar paving laid upon 8 in. of cement concrete. In the centre of this new promenade two oval-shaped flower beds have been laid out, which form a pleasing feature to this portion of the Esplanade. The author was about to effect another very necessary improvement to the Marine-drive and promenade west of the pier in front of Lansdowne boarding house when the war broke out. Everything was in readiness, the scheme was to cost £8,688 3s. 4d., £2,000 of which was to come as a contribution from the Local Government Board on the recommendation of the Central Unemployment Body for London. As the scheme necessitated going out to sea 47 ft., to which there was some opposition from the ratepayers, the council decided to call in Prof. Mathews, of the University of London, late borough engineer of Bridlington, who agreed with the scheme in its entirety, and these are the concluding words of his report to the urban council: "I am quite sure that the works you propose to carry out at Bognor will be in no way detrimental to the foreshore, and a great improvement in this part of your sea front will be made. The scheme prepared by your engineer is a good one and has my entire approval."

The scheme consisted of widening the highway opposite Lansdowne boarding house, which is now only 16 ft. wide, and is without a kerb or footway on either side; this was to be increased to 50 ft., 8 ft. of which was to be used as a footway on the north side of the street. The foundation of the road was to be constructed with 12 in. of hardcore and finished with 4½ in. of tarred granite rolled down to 3½ in. The promenade opposite the Steyne is now only 15 ft. in width; this was to be increased to 33 ft. The sea wall was to have been faced with blocks, but to contain no flints, the surface facing seawards being made with granite chippings and cement 6 in. thick. A bull-nose was to be constructed in the same way as had been already described, upon which a heavy pattern galvanised railing and standards was to have been fixed. The wall was very substantial in design, and was to have been let 3 ft. 6 in. into the blue clay, the foot of which facing seawards was to have been close piled with 12-in. by 8-in. beech piles. The wall was to have had counterforts and cross-walls running north and south at intervals which would allow of the work being done section by section until the whole work is constructed and supported from behind by filling in. The promenade was to have been paved with 2½ in. of limestone tar paving laid upon a cement-concrete foundation, the groynes to have new heads and extended seawards, the roadway to be provided with ten culverts to take away the storm water. The scheme was absolutely necessary, owing to the very narrow roadway and the weakness of the sea defences at this particular spot where the work was to have been undertaken.

The groyning of the seashore is absolutely necessary, although not very pretty in appearance, as if this was not done the sands and beach would be carried away during the south-west gales with which the coast is swept at times during the winter months. By careful attention to groyning the sand and beach level can be raised so as to lessen the depth, and consequently the pressure, of water in front of the sea walls, which is the aim of all sea defence engineers. When the author was before his council seeking his present position as their engineer and surveyor he was asked whether he considered wooden or concrete groynes best for sea defence purposes. He did not give them a direct answer, but stated that before giving an answer straight away he would prefer to live in the town first, and study the coast and from which direction the gales came. But after many years of experience in Bognor he has pinned his faith to the wooden groynes, as it easier to put on a plank or to take one off as may be required. In the case of concrete groynes these cannot be increased in height or lowered without considerable expense and the ultimate weakening of the groyne.

The Pier.

The pier, which now belongs to the Bognor Pier Company was built in 1865 by a company, and was purchased in 1875 by the Bognor Local Board for £1,200. It was for thirteen years under the author's control, during which period the present structure at the extreme end of the pier was designed and erected by him. It accommodated 450 persons, and formed the only covering on the pier in the way of

a period of forty years. A landing-stage on the east side was also constructed for the steamboat traffic. In 1896 the parish were still clamouring for a better pavilion with more accommodation, and in that year the author designed a pavilion to cost £6000, which was reproduced in THE SURVEYOR, April 12, 1901. It was proposed to erect the building 300 ft. from the shore end of the pier, and it was to provide accommodation for 700 persons. It was never built, and the council ultimately decided to give the pier away if anyone would spend a certain amount on strengthening the structure and building a pavilion, which the present company agreed to do, and the pier passed out of the hands of the council in 1909 for the sum of 10s. 6d., which was the actual amount paid to the town.

REFUSE DESTRUCTOR.

The necessity for the provision of a refuse destructor became apparent in 1910, when the question of satisfactorily dealing with the town's house refuse was very troublesome; for years the local brick-makers used to take it by tender and use the ashes in making bricks, but wherever it was temporarily stored in their yards it brought a plague of rats. At last the council decided to build a destructor, and purchased a site on the extreme north-eastern boundary of the district for £800, containing 5½ acres, and built a Manlove & Alliott's twin-cell destructor fitted with a Babcock & Willcox water-tube boiler, which has answered admirably. During last [illegible] 678 loads of house refuse were burnt, 632 loads of clinkers and 136 loads of ashes were used in road and path construction in the district, 287 loads of ashes [illegible] and the income realised was £45 1s. Being at the rate of £2 2s. 7½d.

COLLECTION OF HOUSE REFUSE.

This important section of the surveyor's duties is carried out by [illegible] carts, two men and [illegible] The collection [illegible] every fortnight during the months of June, August and September, when the carts call once a week. The author has every reason to believe that the work is thoroughly done, as very few complaints ever reach the council's offices.

REPAVING OF THE TOWN.

The repaving of the principal streets of the town was commenced in 1904 at a cost of £3000 and continued in 1907 at £10 and 1910 at £41 when the work was completed. Before this the pavements consisted of [illegible] setts from the shore and Purbeck stone slabs. They were very much worn and dangerous for traffic. These were replaced with 2-in. composition slabs bedded in mortar upon 3½ in. of cement concrete. Norwegian 12 by 6 flat kerbs were used, with a 16-in. South Water brick channelling and a blue Staffordshire brick in the outside course to protect same. All were bedded in cement and laid upon 6 in. of cement concrete. Sykes' patent street gullies have been used in all cases, and have answered very well and given little or no trouble. The rain water from private down-water pipes in most cases have been conducted underneath the paving slabs in iron pipes, and discharged through the kerb stones into the channelling, which is a much better method than allowing them to discharge over the pavement or through an open channel in the pavement, which gets filled with dirt and is never clean and ready for working when the rain comes.

SHELTER SEATS.

Shelter seats are very necessary for invalids to sit in during windy or inclement weather, but at the same time they must be so designed as to be imposing on the sea front. The author is responsible for the erection of the three with flat roofs, which cost £250, the framing of which is of pitch pine upon oak platforms. The roof is covered with stout zinc, and all the windows are glazed with plate glass. The three shelters with span roofs were erected quite twenty-five years ago, and cost £200.

SEWERAGE.

The total length of soil sewers under the author's control throughout the district is 16 miles, and the whole are laid at very flat gradients, and in consequence the flushing of all sewers has to be periodically carried out. Notwithstanding this, smells are very seldom perceived. The system, which is partly a combined one, is by gravitation with an outfall into the sea at Felpham on the eastern boundary. During tide lockage the sewage, in the case of Bognor, is stored in a covered concrete tank, the capacity of which is 300,000 gallons, and in the case of the Bersted system in a 4-ft. circular tank sewer capable of storing 84,000 gallons. The average daily flow is 300,000 gallons. The cost of disposal is about £150 per annum. Ten years ago the author considered some auxiliary help was necessary in the way of pumping machinery, and a scheme was prepared by him for lengthening the outfall pipe to 1,600 ft. and the provision of an engine-house, pumps and the necessary machinery; a consulting engineer was called in, who entirely agreed with what was proposed, but the policy of the council changed. A scheme was prepared by him to go farther eastward and discharge at a point on the coast at Middleton, called Hannah's groyne. But difficulties arose, and ultimately instructions were given to another firm of consulting engineers (owing to the first adviser having retired) to prepare plans, &c., for the discharge of the sewage at the present site, but half a mile further seawards, in 24-in. pipes, and the provision of an engine-house and sump, deep enough to take the sewers from the village of Felpham by arrangement. This scheme is estimated to cost Bognor £12,136. The work was sanctioned by the Local Government Board and has been started; £5,000 has been expended in pipes, &c., but the [illegible] the new [illegible] tipping ground by order of the

HOW CHARITY IS ADDED AT BOGNOR.
One of many models designed by the Town Surveyor. It is mounted on a water cart.

Local Government Board, as is also the Felpham drainage, which was being carried out at the same time by the Westhampnett Rural District Council. The town was sewered in 1878, and the outstanding loan is £8,650.

ISOLATION HOSPITAL.

It is of the utmost importance to a seaside town that they should possess an up-to-date isolation hospital, as if an epidemic were to break out during the summer months a season might be lost to the ratepayers if no such accommodation were available to isolate the patients during the outbreak. The guardians of the Bognor public were alive to this fact, and have built all that was required in the way of an isolation hospital pleasantly situated on the outskirts of the town. Although there is still some criticism when the maintenance and upkeep expenses are asked for, the author looks upon the money expended on this undertaking as one of the safest insurances against disease the local authority has ever invested in. The site is on the north-west of the town in Sheepwash-lane, and was purchased in 1906, when the administration block, which cost £600, was built out of the rates. It contains kitchen, scullery, sitting-room, pantry, coals and water-closet on the ground floor, and three bedrooms and bath-room on the first floor. In 1909 two hospital blocks were erected—one for diphtheria and the other for scarlet fever. Each block contains male and female wards, each containing three beds (but this can be very much increased when needed, as each ward contains 7,581 cub. ft. and 658 sup. ft.), they are well lighted, warmed and

ventilated on the latest principles, and have water-closet and slop-closet intercepted from each ward by a lobby. The wards, which have rebated floors, open on to a well-tiled verandah. The duty-room, which is situated between the wards, is spacious and airy. There is a large hall and vestibule and a bath-room, store and linen cupboard. The wash-house, disinfecting chamber and mortuary is some distance from the isolation blocks. Accommodation is provided for the gate-keeper and caretaker near the entrance gates in the way of a small cottage, which was on the site when it was purchased. The entire amount spent on the hospital, including site, is £3,865. The author has tried to make the buildings as pleasing as possible in design. The outside walls are 11-in. hollow walls, with a "Rowlands Castle" red-face brick base and dressings, above which the walls are cement rendered and lime dashed. The gables are filled in with imitation half-timbered work formed in cement. The roofs are boarded, felted and covered with Rosemary roofing tiles. The drainage system has had special attention, and has inspection chambers at each change of line, and the whole drains are well ventilated. The site is surrounded with two complete barbed-wire fences, 6 ft. 6 in. high and 3 ft. apart, in between which has been planted a quick-set hedge. The grounds are well planted with trees, and the paths laid out, so that the patients can enjoy the beauty of their surroundings.

WINTER GARDENS SCHEME.

To maintain the popularity of the town the urban council have embarked upon a scheme for providing Bognor with a site for winter gardens by the bold purchase of Nos. 1, 2, 3, 4, 5 and 12 Rock-gardens, Nos. 1 and 2 Culver-villas, Aldwick-road, Nos. 7, 7a, 9 and 11 Aldwick-road, at a cost of £6,245, to which the Local Government Board have given their consent and granted a loan for the above amount. There are other properties still to be purchased, and then the whole will be demolished when the time is ripe. This will remove one of the most unsightly blocks of buildings on the sea front, situated, as it is, in one of the best parts of the West End Promenade. It is impossible to say now when the scheme will be matured; but it will provide an invaluable site for the erection of winter gardens overlooking the sea with bandstand and gardens adjoining the promenade, and possibly a bathing-pool, where bathers could bathe all day long, whether the tide was in or out—such as had just been constructed at Scarborough. The scheme will cost over £20,000, and the author has already received instructions from his council to visit other seaside resorts to gain information upon the matter.

ALLOTMENTS.

The allotments in Gravits-lane cost £390, and other allotments are provided in Linden-avenue and on the site of the refuse destructor. The tenants number 101, and are charged 6d. per rod for the hire of the ground.

OFFICES AND COUNCIL CHAMBER.

These are situated in the High-street; No. 68 cost £1,000, No. 66 £750, and No. 70 £660, and the whole form a valuable frontage and site for the erection of municipal buildings, which are very much needed, the present accommodation being quite inadequate for the officers housed in them.

FIRE BRIGADE STATION.

This was designed and erected by the author in 1899, and cost £322. It provides all the accommodation that is necessary at present for the fire brigade, which is a volunteer one and kept up to a high state of efficiency by its officers, Captain E. Wood (postmaster) and Councillor Lieutenant T. Start. The men have a nice reading-room over the station, which is fitted up with a billiard table and other games to keep them on the premises during the winter evenings. There is a large alarm bell fitted in the tower, which is also used for drying the hose. The site of the station is in the High-street, and is taken on lease at £8 per annum. The steam fire engine cost £275, which sum is now paid off.

DEPOT AND STABLES.

These buildings were designed and erected in 1899 by the author without the aid of a contractor, and cost £1,839. They consist of stabling for ten horses, one loose box, and one isolation loose box, harness-room, loft for the storage of hay and straw, cement shed with shop for carpenter and gas-fitter over, engine-shed for steam roller, chair store, block-making sheds in which all blocks for the sea wall are made, cart-sheds, and hot plate for mixing tarred granite upon, coach-houses for the storage of ambulance and van for removing infectious cases with, foreman's office, mess-room for the workmen, and lavatory accommodation. The whole depot is surrounded with a brick wall, 7 ft. high, substantially built.

LIGHTING.

The streets and promenade are lighted on the incandescent system (without by-passes). The actual number of lamps is 421, of which 12 are all-night lamps. The promenade is lighted by 23 three-burner lamps, 6 double-burners (in the shelter seats), and 6 single-burner lamps, all of which are included in the above number. The gas is supplied by the Bognor Gas Company, with whom the council have an arrangement.

PUBLIC LAVATORIES.

The town has spent £1,872 on the provision of public lavatories, which are an absolute necessity in a seaside town to which visitors flock during the summer months. The gentlemen's lavatory, which is built underneath the promenade near the pier, was designed and constructed by the author fifteen years ago. It cost £621, and the accommodation provided is eight water-closets, eight urinal stalls, wash-and-brush-up room and caretaker's room. Two lavatories have been constructed under the parade at the east end of the town. Some difficulty was experienced in carrying out this work owing to the ground in which the lavatory was constructed being "made-up" ground; and in the foundations running sand was encountered; therefore every precaution had to be taken to insure the buildings being watertight when completed. The accommodation in the ladies' lavatory is ample, and include a spacious, well-lighted room furnished with four lavatory basins with hot and cold water, dressing-table, mirrors, and six water-closets. The accommodation in the gentlemen's lavatory is also good, including likewise a spacious room furnished also with four lavatory basins with hot and cold water, dressing-table, six water-closets and six urinal stalls. There is an attendant's room in each lavatory. The inside walls are of white-glazed bricks, with a dado of brown-glazed bricks, from the Leeds Fireclay Company. The floors are of marble, known as "Terrazzo," and laid by Messrs. Marchette, Limited, Portsmouth. The ceilings are formed with cement concrete, in which are bedded steel girders; and the buildings are lighted by sixteen semi-prism lights let into the parade. The ventilation is thoroughly adequate. The drains are all laid on modern lines. Special means are provided, by tanks sunk into the roadway, for flushing each portion from a water-cart. The buildings are also lighted by gas, and the town water is laid on. At the extreme west end of the promenade there are two lavatories for each sex, built above ground, which cost £350. The entrances to these lavatories are side by side, which is not a good arrangement; but this could not be avoided, as the owner of the land would not allow the tamarisk hedge to be cut on the south side to allow of an entrance from that side.

PRIVATE STREET WORKS.

Since 1875 the council have spent £18,894 in making up forty-two private streets, of which thirty-three have been carried out under the author's supervision. At first the work was done under sec. 150 of the Public Health Act, 1875, but seventeen years ago the council adopted the Private Street Works Act, 1892, under which all such work is now undertaken. The mileage of streets taken over is 7 miles. There is only one remark the author wishes to make, and that is the depth of foundation has had to be increased of late years to meet the requirements of the heavy motor-lorry traffic.

REPAIR OF HIGHWAYS.

Special attention is now given to the repair of the highways; only tarred granite is now used for this work where any remetalling has to be done. The last length put down was from West-street to Victoria-drive in the Aldwick-road, which work was done two years ago. The present flint roads will be kept going until they are gradually replaced with tarred granite. The periodical tarring of the principal streets is done when required, distilled tar being used for this purpose and dusted with granite chippings. The total mileage of roads under the author's control is 13½ miles. No main roads exist in the town, and no contribution whatever is made from the county council towards the maintenance of the roads in Bognor, which is considered a very great hardship.

The Surveyor
And Municipal and County Engineer

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BANDSTANDS.

Two bandstands have been erected. The one at the west end has recently been enlarged to take a full military band. It was built fourteen years ago, and is of pitch pine with a tiled roof. The one on the eastern promenade was erected five years ago, and is of the rustic style with rubberoid as a roof covering. A scheme was prepared by the author for providing a sunken bandstand at a cost of £1,200, and a Local Government Board inquiry was held about ten years ago; it was never proceeded with, which is a very good thing now the town has acquired the adjoining land at Rock Gardens, for the winter garden scheme of which the erection of a more up-to-date bandstand will form a principal feature. The council were granted an Order on April 30, 1914, to their Act of Parliament by the Local Government Board whereby they can utilise the money taken from the chairs on the sea front for the provision of military bands, upon which the town now spends from £500 to £600 per annum.

PUBLIC BATHING STATION.

This is situated at the east end of the town, and is a wooden structure made in sections, and is taken down each winter and stored. The charge for a single bath is 2d., towel and costume 1d.

SURFACE-WATER DRAINS.

The surface-water drains in a flat district, and one which is occasionally swept with gales in the winter time, are much needed, especially in the vicinity of the sea front, and consequently large sums have from time to time been expended in improving the system. There is a splendid opportunity to get outlets through the sea wall along the entire front in Bognor; but they require putting in at the right level and with much care to prevent back flooding. Some of these drains are as large as 24 in. in diameter, notably the one in York-road, a district that was at one time very much troubled with flooding in time of storms.

MARINE-DRIVE.

The local authority have from time to time spent large sums in widening and improving the Marine-drive; the last of such improvements was carried out in 1910, when large strips of land were purchased from the owner of Cotswold estate and the proprietor of the Kursaal buildings, which scheme cost the town £1,248. Another obstacle which had to be overcome were the local fishermen, who asserted that they had created a right to place their fishing pots and gear on the south of the road. The difficulty was overcome by the generosity of the then chairman of the council, W. H. B. Fletcher, Esq., J.P., C.C., who offered them a site on the eastern boundary of the town at 1s. 6d. per yard per annum rent, and the council built them a depot complete with pot-making sheds, &c., to carry on their calling which met their requirements and finished what looked like a big law case at one time.

PUBLIC MORTUARY.

This is only a small building, situated at the council's depot in Ockley-road, but is quite complete and up-to-date. The building is fitted with a slate operating table with top light over, and is provided with hot and cold water. Fortunately the town has very few cases in the course of a year to deal with.

THE COUNCIL'S AID TO CHARITY.

The urban council allow their water carts, horses and men each year to be decorated in aid of the hospital, and in this way considerable sums have been given to charity.

In conclusion, I wish to thank the town clerk, Mr. Joseph Jubb, the accountant, Mr. F. W. Lovett, and the collector, Mr. F. L. Booth, for the figures and information which they have so very kindly given me.

SOME RECENT PUBLICATIONS.*

RIVINGTON'S NOTES ON BUILDING CONSTRUCTION. (Parts I. and II.) Edited by W. Noble Twelvetrees, M.I.MECH.E. Price 7s. 6d. nett each part. London: Longmans, Green & Co.

For the past forty years "Rivington's Notes on Building Construction" has been the standard work for architectural, engineering, and building trade students, and it may be safely said that there are few architects and engineers who have reached middle age who have not used it as a text-book as students, and as a work of reference when they became assistants or principals. Time has, however, brought about many changes in building construction, and the introduction of new materials and new methods, especially in the development of reinforced-concrete and steel-framed buildings, has caused the earlier editions of this work to become less useful, and to need a thorough revision so as to bring them up to date.

The original edition has been revised on six occasions, the last edition having been published some ten years ago, and the present edition has been entirely rewritten. Many of the old illustrations are to be found in the new volumes, though there are a large number of new illustrations given. It is a matter of regret that the exigencies of space have led to many of the old illustrations being reproduced on a much smaller scale in the new volumes, and in some cases it has caused overcrowding and loss of clearness. Boldness is valuable for constructional details, and the boldness and clearness of type and illustrations in the first editions gave them a character and value which none of their many rivals have been quite able to attain.

The new volumes, however, cover so much wider an area than the old that this drawback is amply compensated in the fuller treatment it has been possible to give in the new edition to many branches of building construction. A number of new branches are covered, and each subject has been dealt with by a well-known expert under the able editorship of Mr. W. Noble Twelvetrees. New subjects are introduced of special interest to the municipal surveyor or building inspector, such as building regulations, steel skeleton buildings, reinforced-concrete and brick work, fire-resisting materials, drainage and sewage disposal, heating, ventilation and hot water supply, sanitary fittings, gas and electric lighting, electric bells, telephones, lightning conductors, and fire equipment. A very useful list of examination papers, set by the Royal Institute of British Architects, the Board of Education, the Institution of Municipal and County Engineers, and other examining bodies, will be found of great assistance to students preparing for these examinations.

The work is very well written, and can be strongly recommended as a sound guide to students of building construction, and it should find a valued place in the library of every architect, engineer, surveyor, and builder. There are, however, a few points which call for revision in any future issue. In the chapter on foundations it is said that foundations should be 6 ft. below the ground to prevent the variations of

*Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

[illegible] from penetrating to the foundation. This is a counsel of perfection rather than a practical rule, as in such a temperate clime as ours frost or heat have little effect on foundations placed 3 ft. or 4 ft. below the ground, and considerations of economy rarely lead to a greater depth being adopted.

Again it is said that "when building on concrete [illegible] footings are often unnecessary, but no by-laws recognise this, and no such exception is made." This statement is incorrect, as there are a number of local authorities whose by-laws allow footings to be dispensed with where the wall is built on a concrete foundation of a width and depth equal to that required for footings. In the chapter on "Drainage and Sewage Disposal" Roman cement is said to be a very reliable material for jointing drains, and to be extensively employed in Ireland. Few English engineers or surveyors would use it in preference to Portland cement, as its tensile strength is greatly inferior to that of Portland cement. When making joints for drains or sewers it is said that when Portland cement is used "care must be taken to see that it is thoroughly cooled by being spread out on a floor before it is worked into the joints." With the improvements in the manufacture of Portland cement made during the past few years, cooling the cement by spreading on floors has not only been found unnecessary on the largest and most important engineering works, but it frequently leads to the cement becoming so cold and dead that its strength is greatly lowered. All cements made to the British Standard Specification should be sufficiently cooled for all practical purposes, and it is certainly better to rely on a test for expansion or contraction than to assume that all cements for jointing purposes require to be spread out on a floor to be cooled.

Plain and Reinforced Concrete Arches. By J. Melan, K. K. Hofrat, Professor of Bridge Design at the German Technical School, Prague. Authorised translation by D. B. Steinman, C.E., PH.D., Professor of Civil Engineering at the University of Idaho. Price 8s. 6d. nett. New York: John Wiley & Sons. London: Chapman & Hall, Limited, 1915.

This work is a translation of an article entitled "Theorie des Gewölbes und des Eisenbetongewölbe im Besonderen," published in the 1912 revised edition of the "Handbuch für Eisenbetonbau," edited by the well-known Austrian engineer, Dr. Ing. Fritz von Emperger. As our readers are aware, the name of Melan is intimately associated with the development of reinforced-concrete bridge construction, and the extensive employment of his system in the United States is a sufficient justification for the presentation of this translation to the engineers of that country. The position in Great Britain and Ireland is somewhat different, as most of the reinforced-concrete bridges constructed so far represent the Hennebique system. Nevertheless, as the work now under review constitutes a very thorough scientific treatise on reinforced-concrete arches. It is distinctly worthy of attention by British engineers. After briefly discussing the fundamental principles of arch design and the stresses in reinforced-concrete sections, the author gives analytical and graphical methods for the complete designs of various types of concrete arches. Simple approximations and short cuts are also given, and readily applied formulæ are developed for the advance determination of the best curve for an arch, and for the required dimensions and reinforcement. The principle of the Melan system of arch construction is fully explained, and complete calculations of stress are given in the appendix for two notable examples, one being the Polcevera Bridge at Genoa, and the other the Chanderon-Montbenon Bridge at Lausanne. It should be mentioned that all the numerical examples and data have been converted from metric to English units, a feature which will be appreciated by readers in this country. The volume is admirably produced, and is one which [illegible] a trustworthy guide on the subject discussed.

Stability of Masonry and other Structures subject to the Pressure of Earth and Water. By Ernest H. Sprague, ASSOC.M.INST.C.E. Price 4s. nett. London: Scott, Greenwood & Son.

This is one of the admirable Broadway series of engineering handbooks, and it can be heartily recommended to the engineering or architectural student as a safe guide on the subject of earth and water pressure on walls, dams and other structures; of wind pressure on chimneys; of the stresses on, and the treatment of, foundations; and the design of masonry arches and bridges.

The book is written in a simple and practical manner, and the diagrams are both numerous and clear, and admirably illustrate the text. Though both graphical and mathematical methods are used, the greater adaptability and simplicity of graphical methods has led the author to give greater prominence to graphical than mathematical methods.

A number of useful examination questions are given, and many examples worked out, which make the work of great value to students who intend to sit for the Institution of Civil Engineers' or the Institution of Municipal and County Engineers' examinations.

The experience of the author as a lecturer on engineering subjects at University College, London, enables him to present his views in language suitable to the intelligence and experience of the student. The book will, however, also appeal to older and more experienced engineers and architects as a very useful and reliable work; and it should do so, especially to municipal engineers and surveyors, who are so largely responsible for the design of retaining walls, dams, chimneys, foundations and bridges.

Materials of Construction: Their Manufacture, Properties and Uses. By Adelbert P. Mills. M.S.(C.E.). Price 19s. nett. London: Chapman & Hall, Limited.

The author of this work is an assistant professor at the College of Civil Engineering, Cornell University, and the book is intended primarily for use as a text-book covering the manufacture, properties and uses of the more common materials of engineering construction. Though intended chiefly for the use of students, it will be found of great assistance to all engaged in engineering constructional work. All the chief materials are dealt with in a thorough and systematic manner, and the consideration of each material, or class of materials, is prefaced by a discussion of its ordinary application in engineering construction, followed by a description of its manufacture and the physical and mechanical properties in their relation to its uses. The work contains a number of valuable tables and diagrams, and numerous illustrations of the plant and machinery employed in the manufacture of the various materials are given. The principal materials described are gypsum, plasters, quicklime, hydrated and hydraulic limes, Puzzolan and slag cements, natural cements, Portland cement, concrete, stones, bricks, terra-cotta, pig-iron, cast iron, malleable cast iron, wrought iron, steel, copper, lead, tin, zinc, aluminium, nickel, and timber. The book is well written, and though it deals largely with American machinery and methods, it will be found a very useful work by English engineers and manufacturers, and all engaged in practical engineering construction.

Wayfarings Round London. By "Pathfinder." Price 2s. 6d. nett. London: Frederick Warne & Co.

The rambles described in this excellent little book—which is of a convenient pocket size—originally appeared in the columns of the *Evening News*, and it was a happy thought on the part of the Homeland Association to republish them in this more permanent form. The route of each of thirty rambles is carefully described, while the possibility of mistakes is further avoided by the presence of a plan of each. The extracts at the head of each ramble form an anthology from authors who have loved the footpath way, and give the little book a literary touch lacking in the usual bare record; and the author has a happy method of making each ramble not only helpfully practical, but also readable. In these days of economy the field ramble as a form of innocent enjoyment should increase in popularity, and those who intend to try it cannot do better than begin by purchasing a copy of this book.

Halifax: A Commercial and Industrial Centre. An Illustrated Handbook concerning the Town's Present Position and Future Promise. Price 2s. 6d. London: Sells, Limited.

The aim of this handbook, which is issued under the auspices of the local Chamber of Commerce and Chamber of Trade, is to show manufacturers and merchants at home and abroad the vast range of work produced from the district of which Halifax is the centre, and by demonstrating the advantages of the town's position to attract those contemplating setting up some new works.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Students and Assistants' Associations in the United Kingdom, overseas and abroad are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

[illegible] is awarded to

Mr. J. G. WILKIN,
County Surveyor's Office,
Downpatrick,

[illegible] in the opinion of the [illegible] received during the month.

QUESTIONS.

Last week students are invited to the following questions:—

503. Sewer Construction. AB and CD are two 18-in. circular pipe sewers, intercepted at right angles by a railway in a cutting with slopes of 1 in 2. The fall of AB is 1 in 140 and CD 1 in 360. The invert level of B is 122·3, C 120·7, ground level 128·0, and level of railway metals 106·50 ft. above [illegible] datum. Distance from B to C is 110 ft. Describe and show by sketches in detail how to connect the sewers AB and CD, showing provision for cleaning and inspection. The fall of both sewers is towards D. The railway company will not allow any sewer to pass underneath the railway unless at a greater depth from top of sewer to top of rails of 4 ft. (E. H., *Walkden.*)

504. Bridge Design.—A bridge is required to carry a 60-ft. street over a canal, the clear span being 40 ft., the minimum head room being 11 ft. at centre and 9 ft. at sides above normal water level. The approaches are rising gradients of 1 in 24 and 1 in 90 respectively. Sketch the bridge you recommend for such a position, giving all important particulars, short specification tests for materials, and tests for bridge when completed. (P. W., *Pontypridd.*)

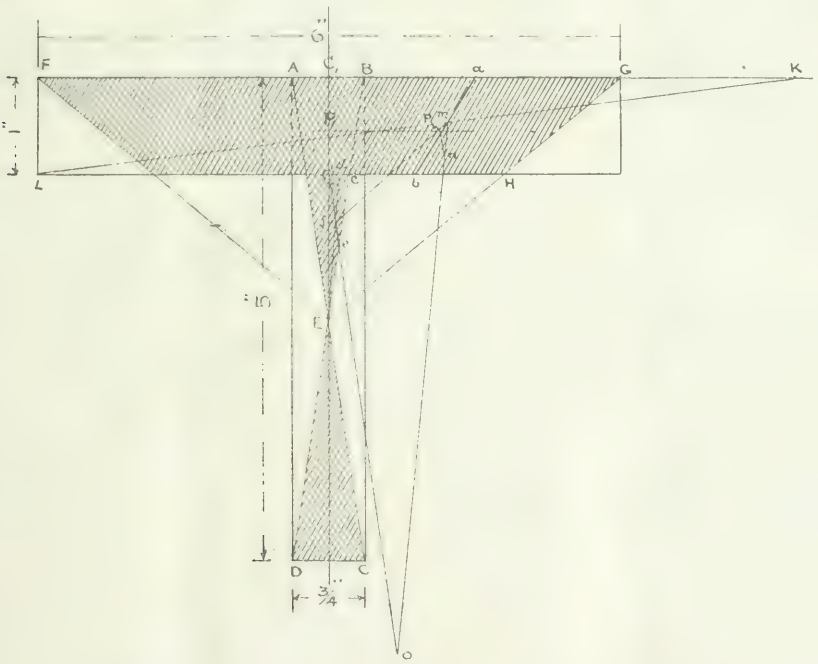
505. Retaining Wall. Design a retaining wall in [illegible] concrete [illegible] detail the calculations. The [illegible] of proposed wall 35 ft., earth retained, dry gravel; foundation similar. (H. T.)

506. Concrete Sewer Construction.—Is it necessary to support concrete sewer tubes with concrete at the sides, the tubes being 21-in. diameter? If it depends on the depth below the street whether they should be supported by concrete or not, then what are the least and greatest depths at which they can be laid without concrete support at the sides? ("Polox.")

507. Design of Retaining Walls.—What are some good practical rules for the design of (1) brick and (2) concrete (not reinforced) retaining walls to withstand earth pressure? ("Polox.")

REPLIES TO QUESTIONS.

502. Theory of Beams. The cross-section of a beam is T-shaped, the upper table is 6 in. wide and 1 in. thick, the vertical web is 5 in. deep and ¾ in. thick. At a certain cross-section this beam is subjected to a known bending moment. Make a careful sketch to show the distribution of the stress across the section produced by this bending moment. (C. W. P., *Wellington.*)



Locate the centroid E. Join FE and GE, obtaining points JH. To take account of web join AC, BD. The shaded portion is the section of an imaginary beam of equivalent value to the actual beam in resisting a bending moment, having every layer stressed to the same extent as the outer layers of the actual beam. To obtain the centroid P_1 of the table bisect CG in *a* and CH in *b*. Join *ab*. Produce C_1G to K, making $GK = C_1H$. Join KL, intersecting *ab* at *m*, then *m* is the centroid of the trapezoid C_1C_2HG. To find the centroid of triangle C_2E, bisect C_2 and E in *c*. Join *dc* and [illegible] cutting at *f*, which is the centroid required. To find P divide line *fm* into segments inversely

proportional to the areas of the trapezoid and triangle; thus,

$mP_1 : fP_1$ = area triangle C$_1$eE : area trapezoid C$_1$C.HG

= ·156 : 2·416

= 1 : 15·487

To divide fm in this proportion, draw from m, at any angle to fm, mo, and set off $mn = 1$ and $no = 15{\cdot}4\ldots$ Join of, and draw nP parallel to it. P$_1$ = centroid of table. (E. W. P., *Southampton.*)

Before the diagram can be drawn, it is necessary to find the centre of gravity of the section through which the neutral axis passes. It is evident that it will be on the centre vertical line of the section, and it is required to find its distance from AB. Let x = this distance.

Taking moments round AB, we have

$$6 \times 1 + (5 \times \tfrac{1}{4}) \cdot 3\tfrac{1}{2} = (6 + (5 \times \tfrac{1}{4})) \cdot x$$

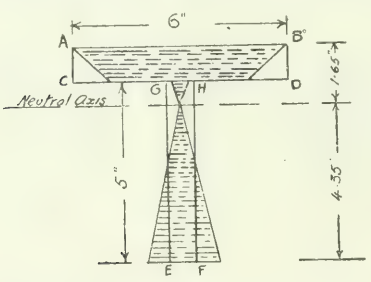
$$\frac{129}{8} = \frac{39}{4} x$$

$$129 = 78\,x$$

$$1{\cdot}65 = x$$

∴ the centre of gravity is 1·65 in. from AB.

The known bending moment must not produce a greater intensity of stress at the extreme fibres than the material can withstand with safety. The fibres above the neutral axis are in compression, and those below it are in tension, and the stress at any section is proportional to its distance from the neutral axis. If the T-section is of steel, then the tensile stress



at EF should not exceed 6 tons per square inch. When the material at the extreme fibres EF is undergoing its limiting stress of 6 tons per square inch, the material at AB is only being called upon to withstand a stress of $f = \frac{1{\cdot}65 \times 6}{4{\cdot}35} = 2{\cdot}27$ tons per square inch, and at CD the stress $f_1 = \frac{6 \times 1}{4{\cdot}35} = 1{\cdot}38$ tons per square inch.

Taking a 1-in. thick section of the T-iron, the distribution of stress diagram is obtained by multiplying the area of any horizontal section parallel to the neutral axis by the stress at that section.

i.e., at AB	6 × 1 × 2·27	= 13·8 in.-tons
„ CD	6 × 1 × 1·38	= 8·28 „
„ GH	4 × 1 × 1·38	= 1·03 „
„ Neutral axis	4 × 1 × 0	= 0 „
„ EF	4 × 1 × 6	= 4·5 „

These inch-tons units, plotted to a suitable scale (shaded in figure), gives the required diagram, illustrating the distribution of stress across the section. (J. G. W., *Downpatrick.*)

501. Ventilation.—In designing a system of ventilation for a public hall, what are the relative advantages of a small number of large inlet shafts, compared with a large number of small shafts; and at what level should these inlets be placed? (C. W. P., *Wellington.*)

Buildings constructed so that the internal air is constantly changed and kept as pure as the external air, or so that the internal air is vitiated to so slight an extent that any ill effects are scarcely perceptible, are said to be well ventilated. Whether this can be better effected by a large number of small inlet shafts or a small number of large inlet shafts is an open question. Generally speaking, air inlets, whether large or small, should be kept low down, and the air outlets high up, and in opposite positions. Some of the arguments put forward for and against the above contentions are as follows: (1) A large number of small inlets, occurring at frequent intervals, causes a more uniform distribution and diffusion of fresh air throughout the hall, and the supply can be easily regulated. (2) With a large number of small inlets, draughts are not so likely to be set up, as the volume of air entering at one place is small, and consequently its velocity is low. The incoming air does not therefore follow a direct path to the outlet, but mingles with the air of the hall, and travels at a slow rate to the outlet. (3) When large inlets are adopted there will not be a uniform diffusion, and change of air in the hall and offensive draughts may result. (4) Large inlets are more easily constructed than a number of small ones admitting the same volume of air, so it is more economical, as far as first cost is concerned, to use large inlets. (5) It is more economical to use large inlet shafts if it is desired that the air should be slightly warmed before entering the hall, either by burning gas in the shaft or by fixing hot-water or steam pipes in the lower part of the shaft. (6) When large inlets are used and kept open, outlets in the ceiling are not likely to transform themselves into disagreeable inlets, thus causing a down draught. Taking the question as a whole, it is preferable to have a large number of small inlets rather than a small number of large inlets. The height of the inlet shafts should be about 8 ft. above floor level, so that the incoming cool air may not impinge upon the bodies of persons in the hall. (J. G. W., *Downpatrick.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

Waterproofing of Floors.—What is the best material for factories and workshops where water is used for flooding the floors? At Plymouth the upper floor of a garage used for motor washing has been made wet repellent by a waterproof cement rendering. It was most important that this floor should be made waterproof as the fitting and lathe shops were directly underneath. The manufacturers of Pudlo inform us that the architect is pleased with the result.

Housing in Sedgefield Rural District.—The surveyor to the Sedgefield Rural District Council, Mr. J. Stones, reported recently that he had certified the final payment on the Trimdon housing contract. The whole of the work was let for the sum of £5,124, and had been carried out for £5,070 14s. 10d.—a reduction of £53 5s. 2d. on the contract. He allowed the sum of £159 for contingencies, and of this item £96 14s. 10d. had been expended. This was accounted for in making the end street 36 ft. wide instead of 18 ft., as originally intended; the provision of a large cupboard in the front bedrooms and the graining of the fronts of the houses instead of painting as required by the specification.

Ireland and Town Planning.—At the annual conference of the Association of Municipal Authorities of Ireland, which was held in Dublin last week, Mr. Geo. L. O'Connor presented an interesting paper entitled "Some Aspects of Town Planning." Mr. O'Connor remarked that they were handicapped in Ireland by not having the advantage of the Town Planning Act, which had proved such an immense benefit in the cities and towns of Great Britain; but he hoped that when the war was over Ireland would be in possession of her own laws, and that the Town Planning Act would be one of the first Acts to be put in force. He mentioned some of the chief points with reference to air space, proper building lines, sanitary arrangements, and the character of the buildings to be erected. All this meant the preparation of a proper civic survey and town map, carefully planned on a large scale, and available for public reference. He saw no reason why they should not adopt the procedure followed in Germany, America, and England and Scotland. The economic value of proper and well-considered town planning was in itself a very great factor, and he would like to see their capital city setting a strong lead in the matter.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Birkenhead T.C. (September 21st. Mr. Courtenay [illegible]).—This was an inquiry with respect to the scheme of the application for the erection of workmen's houses. The town clerk (Mr. J. Fender) stated that the sum proposed to be borrowed was £68,500, and in schemes under the Housing Acts [illegible] sanctioned. The desire of the council to proceed with a more comprehensive scheme than any hitherto undertaken had been intensified in recent years, owing, on the one hand, by the falling off of private building which followed the passing of the Finance Act, and on the other, by the very rapidly increasing industrial population of the town, due to a large accession of work in connection with the principal labour employing firm in the borough—viz., Messrs. Cammell Laird's. The application was made to obtain the board's permission to appropriate the Gilbrook site under sec. 57 of the Act of 1890, which was acquired by the Birkenhead Improvement Commissioners, the predecessors of the corporation, in 1843, under a local Act of Parliament. The site now intended to be used for the housing scheme was a portion of the unsold land, consisting of nearly 8 acres, including street sites. A joint report on the need for working-class dwellings was submitted to the board in May, 1914, and as a consequence the Health Committee formed a policy of carrying out a scheme for the erection of about 200 houses at the north end, 100 in the central area, and 100 in the southern area. The present scheme was intended to be the first instalment of this policy. Plans for the property to be erected on the Gilbrook site were prepared by Mr. T. T. Rees.

Leeds T.C. (September 15th. Mr. George L. Pepler).—This was an inquiry in reference to an application by the corporation, under Part II. of the Housing and Town Planning Act, 1909, for authority to prepare a town planning scheme for the Gledhow estate.—The city engineer, Mr. W. T. Lancashire, stated that it would probably be necessary to construct a main road along the valley from Roundhay-road to Harrogate-road, and one or two others, with the object of facilitating development. During the past twenty-one years there had been a big drop in the number of houses built annually, the maximum of 3,000 in 1900 having fallen to 200 in the year ended March last. Those figures, coupled with the reduction in the number of unoccupied houses—from 7,000 in 1911 to 2,000 in 1915—indicated that there must be a considerable amount of building in the near future. Between 1901 and 1911 the building of 15,000 new houses was in excess of requirements, for in the same period the increase in the population was only 16,000. The surplus, however, was being exhausted. New factories were springing up, and generally an increase in the population might be expected.

Swansea T.C. (September 21st. Mr. A. G. Drury).—This was an inquiry with respect to the sewerage scheme.—It was stated that sanction had been obtained to the borrowing of £33,000 for the purposes of general sewerage works, and the relief of the periodical flooding in the Landore district was to form part of these works. Meantime the Treasury put restrictions upon capital expenditure on works that were not absolutely necessary, and nothing could be done. As a result of damage caused to the household effects of a number of people at Landore by the last heavy rains, claims have been sent in to the corporation, and in at least one case an action at law is threatened. The corporation, while denying all liability, thereupon instructed the borough engineer, Mr. R. H. Wyrill, to continue his plans for affording relief.

APPLICATIONS FOR LOANS.

Chesterton R.D.C.—£1,200 for making up roads.

Watford U.D.C.—£1,560 for electricity mains extension.

LOANS SANCTIONED.

Halifax T.C. £20,000 for the purchase of a turbo alternator.

Luton T.C.—£2,000 for sewage pumping plant.

Pontypool U.D.C.—£270 for the purchase of a site for a slaughter-house and stables.

Watford U.D.C. £380 for work of road improvement.

FORTHCOMING INQUIRIES.

OCTOBER.

5. **Hyde.** For public baths extension (Mr. P. M. Crosthwaite) 2,400
5. **Pembroke.** For works of water supply (Mr. A. W. Brightmore) 1,742
6.—**Northallerton.** For the purposes of the water undertaking (Mr. P. M. Crosthwaite) 10,000
7. **East Dean.** For works of water supply (Mr. A. W. Brightmore) 7,000

CORRESPONDENCE.

Εις ἀνηρ ὁυ πάντ' ὁρᾶ
(One man does not see everything.)
—Euripides.

COST OF SCAVENGING IN GLASGOW.

To the Editor of The Surveyor.

Sir,—I observe at p. 313 of your issue of 17th inst. a paragraph to the effect that "the cost of scavenging in Glasgow would appear to be extremely high, amounting to no less than 9s. a ton." I cannot allow this statement to go unchallenged. In the first place, your contributor takes the gross expenditure for the year to May 31st last. If he had looked to the other side of the account he would have discovered a revenue of £44,350 9s. 3d., which he is surely entitled to take into consideration. Had he done so he would have found that the nett cost of cleansing operations in Glasgow works out at not 9s. per ton, as alleged, but 7s. 4·91d. per ton. I would point out further, that even this figure of, say, 7s. 5d. per ton is misleading in respect that, in addition to the removal and disposal of all city refuse, there is included the cost of watering and hose-washing the streets.

Your contributor's reference to street cleansing on Sundays is incorrect. All the chief thoroughfares and principal back courts receive attention on Sunday mornings.—Yours, &c.,

W. Greig, Superintendent.

Glasgow.
September 29, 1915.

New Municipal Offices at Honley.—The formal opening has taken place of the new municipal offices at Honley, built at a cost of £7,500. Messrs. J. Berry & Sons, Huddersfield, were the architects.

Isolation Hospital Extension at Ilford.—The new phthisis pavilion at the Ilford isolation hospital, built at a cost of about £1,600, has been formally opened. The plans were prepared by the surveyor, Mr. H. Shaw.

Change of Address.—Owing to the rapid extension of their business and consequent need of larger premises, the Ironite Company, Limited, have removed their offices to 11 Old Queen-street, Westminster, S.W. (telephone No., 5,618 Victoria; telegraphic address, "Thormotvin, Vic., London").

Omagh's New Town Hall.—The new town hall at Omagh, erected at a cost of about £4,000, has been completed. The frontage of the buildings is 47 ft., and they extend back a distance of over 160 ft. The main assembly hall, which is 85 ft. long, 37 ft. wide, and 28 ft. high, will accommodate over 600 persons.

Sewage Disposal at Dalkeith.—The sewage purification works at Newmills, Dalkeith, were formally opened last week. Messrs. G. Thomson & Ferguson, Glasgow, were the engineers, and Mr. J. Monteith the contractor. There are two main collecting sewers—one to the south along the Benbugh Burn route, and the other to the north. The greater portion of the sewage of Dalkeith previously entered the South Esk, which had become virtually a sewer. While that was the most pressing section, the town council took the view that, as far as possible, all the burgh sewage should be brought to the new works, and accordingly a second main sewer has been carried round by the north-east end of the town, from which it doubles back into the High-street, thus collecting the large volume which formerly joined the South Esk just outside the Duke of Buccleuch's park.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below:—Buildings—Newcastle-upon-Tyne; roads and materials—Brigg, Norfolk, St. Germans; sewerage and sewage disposal—Coatbridge, Falmouth; water, gas and electricity—Braintree, Glasgow, Lancaster, Llanelly, Neath, Sedgefield. Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Gravesend T.C. Additional coal storage is to be provided at the electricity works, at an estimated cost of £250.

Newcastle-upon-Tyne T.C.—The Tramways Committee have received authority to purchase a site for the extension of the tramcar sheds and for the erection of offices.

Twickenham U.D.C. The surveyor, Mr. F. W. Pearce, has received instructions to build a temporary shelter for housing the motor fire engine and escape, at an estimated cost of £50.

Woking U.D.C. The tender of the Municipal Contracting and Engineering Company has been accepted for the reconstruction of Hermitage Bridge.

HOUSING AND TOWN PLANNING.

Annfield Plain U.D.C. It has been decided to purchase a site for the purpose of building workmen's houses.

Herts C.C.—Plans for 100 cottages have been approved provisionally by the Housing Committee.

PARKS AND OPEN SPACES.

Middlesbrough T.C.—The Parks Committee are giving consideration to a proposal for the cultivation of vegetables in the parks and open spaces.

REFUSE COLLECTION AND DISPOSAL.

Rugby R.D.C.—It has been agreed to undertake the work of house scavenging in the parishes of Bilton, Dunchurch, and Newbold by direct labour.

ROADS AND MATERIALS.

Blandford T.C.—Negotiations are in progress with the rural district council for the widening and improvement of Black-lane.

Brigg R.D.C.—A scheme is under consideration for the diversion and improvement of the road at North Killingholme, at an estimated cost of £2,800.

Broadstairs U.D.C.—As the owners have failed to carry out the notices served upon them with respect to the paving of backyards, the surveyor, Mr. H. Hurd, has been instructed to execute the necessary works set out in such notices pursuant to sec. 25 of the Public Health (Amendment) Act, 1907, the cost of such works to be recovered from the owners in the manner provided by the Act.

Loughborough R.D.C.—A letter was read from one of the contractors for stone carting, stating that he could not make it pay at 1s. 6d. per ton, and asking for an increase of 6d. per ton on his contract price. The surveyor, Mr. H. J. Morgan, said the price used to be 1s. 6d., and was increased to 1s. 9d. last year, but this man tendered at 1s. 6d., and got the contract. The chairman could not understand why these people should cut each other's throats by running the prices down so that they could not make it pay. Mr. Braund: He secures the contract by cutting down the price, and then whines because he can't make it pay. It was resolved to make no change in the contract prices.

Norfolk C.C.—Provided a satisfactory grant is obtained from the Road Board, the Western Highways Committee propose to improve and widen the Lynn and Ely road, at an estimated cost of £2,000.

Ossett T.C.—Representations are to be made to the Local Government Board with a view to a loan for making up Hollands-road and Intake-lane.

St. Germans R.D.C.—Consequent upon the condition of the road from Barraton Coombe to Cross Park, owing to heavy military traffic, the council have asked the War Office to meet the cost, estimated at £1,000, of reinstating the highway.

Stanley (Durham) U.D.C.—The surveyor, Mr. A. Routledge, has been instructed to prepare specifications in connection with the proposed construction of private streets at South Moor.

Wembley U.D.C.—The surveyor, Mr. C. R. W. Chapman, has been asked by the Munitions Department to make arrangements for the construction of a road at Alperton, at a cost of £872.

SEWERAGE AND SEWAGE DISPOSAL.

Amesbury R.D.C.—The chairman, Mr. G. F. Gay, reported that he had attended a conference with representatives of the county council and the Road Board at which it was agreed that each would recommend their respective authorities to pay one-third of the cost of the drainage scheme. These terms were now approved by the rural council.

Coatbridge T.C.—In view of a letter from the Treasury suggesting to the town council that they should postpone operations in connection with the sewage purification scheme till after the war, on account of the scarcity of labour and the financial condition of the country, the town council, after giving the matter consideration, have decided, on account of the progress already made, to proceed with No. 1 contract, that of the erection of the works at Langloan. It was held that to stop the progress of the works now would mean a loss of several thousand pounds.

Falmouth T.C.—A letter has been received from the Local Government Board stating that they were unable to sanction a loan for the Market Strand drainage scheme, although it might mitigate some of the nuisances complained of. The council have instructed the borough surveyor, Mr. H. E. Tresidder, to submit plans for carrying out the scheme in sections, the full scheme to be submitted for the approval of the Board of Trade.

Hinderwell U.D.C.—The surveyor, Mr. W. Lawson, has received instructions to erect two sewer ventilators in the town.

South Stoneham R.D.C.—The council have adopted a report by the North and South Stoneham Drainage Committee with regard to the disposal of the sewage from the Remount depot at Swaythling. They recommended that if the War Office would carry out certain work, estimated at £2,200, then the council would undertake the disposal of the sewage upon the payment of £200 per year.

Uckfield R.D.C.—The surveyor, Mr. J. Taylor, has received instructions to prepare plans and obtain tenders for drainage work at Buxted, at an estimated cost of £100.

Willesden U.D.C.—It is proposed to carry out sewerage work in Uffington-road, at an estimated cost of £220.

Winchester R.D.C.—It has been agreed to reconstruct the culvert at Rowlake at a cost of £95, half of which will be paid by the Eastleigh District Council.

WATER, GAS, AND ELECTRICITY.

Basingstoke T.C.—It is proposed to carry out extensions of the water mains at an estimated cost of £430.

Braintree U.D.C.—It was reported to the council that a majority of the inhabitants had voted in favour of an electric lighting scheme.

Glasgow T.C.—New electricity works are in course of erection at Dalmarnock. The first portion of the works consists of a water intake from the river Clyde, a screening-house, two water culverts—one for the inlet condensing water, and the other for the outlet water—a switch-house, a turbine-room, two boiler-houses, workshop and store, and a complete coal-handling plant capable of dealing with 100 tons of coal per hour. The work now proceeding was contracted for prior to the war, the cost including £50,000 for excavations, &c., and £25,000 for coal-handling plant. It is not proposed to place the contract for the buildings or issue specifications for the first instalment of the machinery until after the war. The

first instalment of the machinery will consist of three 10,000-kw. 20,000-h.p. turbines, which will be coupled direct to alternating current generators; also three 1,000-kw. 1,300-h.p. turbo sets for driving auxiliary machinery. It is proposed to add plant units of 15,000 kw. as the demand increases, while turbines of 30,000 kw. can be installed if found to be necessary. The ultimate capacity of the Dalmarnock works will be about 150,000 kw. or 200,000 h.p. It is intended to transmit electricity at a pressure of 20,000 volts (three-phase alternating 25 periods per second) to distributing centres at Port Dundas, Springburn, Partick, Cathedral-street, Osborne-street, Waterloo-street, Pollokshaws-road, Govan, Linthouse, and Dalmarnock.

Keighley T.C.—The council have accepted the tender of Messrs. J. Smith, Keighley, at £783, for the supply and fixing of a 10 ton hand travelling crane, together with a length of fixed gantry, and also the tender of the Rees Roturbo Manufacturing Company, Limited, Wolverhampton, at £350 for the supply and fixing of an electrical Rees Roturbo patent pressure chamber centrifugal pump to deliver 200,000 gallons of water per hour.

Lancaster T.C.—The council on Wednesday adopted a proposal by the Gas and Finance Committee to seek Parliamentary powers by a Provisional Order to borrow £80,000 for present and prospective enlargement of the gasworks. It was stated that £7,000 was needed to instal plant for the immediate production of gas to meet the ordinary and special needs of the town, and it is proposed to borrow £10,000 to restore the reserve fund, which had a year or two ago been transferred to be used as a working balance. In the course of the discussion there was some criticism of the action of the council in taking from year to year the whole profits of the Gas Committee towards rates, and so leaving the undertaking without any reserve fund to meet an emergency.

Llandudno U.D.C.—After considering a joint report by the engineer, Mr. E. P. Stephenson, and the deputy engineer, Mr. W. T. Ward, the council have decided to dispense with the water mains which are laid under the river Conway near Talycafn, one of which had burst in a position in which much difficulty would be experienced in repairing it, and to lay instead a duplicate 9-in. main alongside the 15-in. main to the Talycafn Bridge. The 15-in. main, which was completed about a dozen years ago, extends to the Talycafn Bridge and thence to Llandudno. Two 12-in. mains are laid over the bridge, and have a capacity nearly equal to the 15 in. and the 9 in. combined, so that it will not be necessary to obtain any further easements with respect to the bridge. The cost of the new main will be about £3,000.

Neath T.C.—It is proposed to lay new gas mains, at an estimated cost of £1,000.

Ripley U.D.C.—The agreement with the Butterley Water Company having lapsed, the council have decided to take an additional supply from the Ilkeston and Heanor Water Board at 9d. per 1,000 gallons.

Sedgefield R.D.C.—A report has been submitted stating that the cost of a water supply for Trimdon would be £12,000.

Tynemouth T.C.—The provision of a water supply for Ashington is being considered by the Water Committee.

Road Damage in the North of Scotland.—In the valley of the Nairn near Re-escallow, public roads in some cases are so torn up as the result of floods as to be quite unrecognisable. At one point for fully 30 yds. the onrush of water has cut into the road a trench 5 ft. or 6 ft. deep. Other roads in the same district have also suffered much, and the county council have found it necessary to close ten public roads throughout the county owing to their dangerous state.

Burnley Waterworks Extension.—The Local Government Board, after sending an inspector to examine the works at Hurstwood, where a new reservoir is being constructed by the Burnley Corporation, have decided to sanction the raising by the corporation of £75,000, which is the balance of £215,000 originally authorised to be borrowed. They intimate that they have done this to enable the works to be brought to a stage at which they could safely be left until the war is over. As the £75,000 will be exhausted this winter, the General Purposes Committee of the corporation have decided to promote a Parliamentary Bill next session to secure further borrowing powers.

PERSONAL.

Mr F. Sargeant, surveyor to the Dover Rural District Council, who has been indisposed, hopes to take up his duties again shortly.

Mr. E. H. Crump, engineer and surveyor to the Hinckley Urban District Council, has been gazetted Captain in the Royal Engineers.

Mr. L. J. Stevens, assistant surveyor to the Hornsea Urban District Council, has been gazetted a commission in the Kent Fortress Engineers.

Mr. James Blakley has been appointed surveyor to the Portadown Urban District Council, in succession to the late Mr. William Wilson.

Mr. John Williams, surveyor to the Aberdare Urban District Council, has had his salary increased by £35 this year, with annual increments of £5 to £300 a year.

Mr. James Donnelly, Enniskillen, has been appointed surveyor and sanitary inspector to the Enniskillen Urban District Council, in succession to the late Mr. Thomas Elliott.

Mr. J. W. Jones, engineer and surveyor and sanitary inspector to the Lyme Regis Corporation, has been appointed engineer, surveyor and sanitary inspector to the Urban District Council of Raunds, Northamptonshire.

Mr. F. Slaughter, surveyor to the Steyning West Rural District Council, will supervise the work of the surveyor's **department at Southwick, in the absence** at the urban council's surveyor, Mr. C. W. Warr, on active service.

The Finance Committee have decided that the salary to be paid to Mr. Nisbet in respect of the duties devolving on him as holder of the combined office of city engineer and master of works be £1,000 per annum, and that the question be reconsidered at the close of the war.

Mr. Peter Fisher, general manager of the Dundee Corporation tramways, was on Friday last elected president, and Mr. H. Mozley, general manager of the Burnley Corporation tramways, vice-president, of the Municipal Tramways Association. Mr. C. J. Spencer, general manager of the Bradford Corporation tramways, was at the same time re-elected as hon. secretary.

Mr. H. V. Lynam, surveyor to the Alsager Urban District Council, has been presented with an illuminated address by the councillors and officers on the occasion of his marriage. In the course of the proceedings complimentary reference was made to Mr. Lynam's services in connection with the sewage disposal and water supply schemes, and to his industry in carrying out "the tremendous amount of detailed work which the post of surveyor entailed." Mr. Lynam, in the course of his reply, said he could safely say that he had done a little for roads the improvement of Alsager.

Mr. E. J. Stead, county surveyor of Somerset, who is on active service, writes that his battalion is within sound of the German guns. "We are having plenty of work," he adds, "5.30 to 10 p.m., but it is both useful and interesting. We are billeted in an old convent, which has been badly knocked about by shells. We are well and fairly comfortable, and I would not have missed it for worlds." Mr. Stead emphasises the urgent need for a supply of good steam rollers. The roads of France are in a deplorable condition, and engineers have a tremendous task to tackle and accomplish.

We find that in reproducing in our issue of September 17th the paper entitled "Town Planning and Sanitation," which was presented at the recent annual congress of the Incorporated Sanitary Association of Scotland, a mistake arose in the printing of the name of the author, Mr. Wm. Ross Young, town planning engineer, Lanarkshire County Council. We tender our apologies to Mr. Young for the error.

Town Planning Schemes. It is understood that the Local Government Board have given authority for the preparation of four further town planning schemes under the Housing and Town Planning Act of 1909. Schemes are authorised to be prepared by the corporations of Croydon, Mansfield, and Nottingham, and the urban district council of Seaton Delaval, and relate to areas of about 800, 3,700, 500, and 2,000 acres respectively.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Has not another instance recently been brought to light of the extraordinary increase of motor-omnibus traffic on our roads in Mr. Gettings' recent report on the roads of Worcestershire? Is it not remarkable that in September, 1912, there was no such traffic, whereas now there are motor-'bus services running over 192 miles of main roads in this county? Where is this going to stop? Is it not possible that in a few years' time there will scarcely be a road in England which will not be subjected to this punishing description of traffic? Will road engineers be able to cope with the problem unless they have more money at their command?

* * * *

Is it not to be hoped that the appeal of Mr. Yapp, the general secretary of the Y.M.C.A., in a recent issue of The Surveyor, for helpers in our soldiers' camps will meet with cordial support? Is it not well known that the recreation rooms and other facilities for amusements for soldiers have been generously provided by this excellent institution, and should we not all try to give up some of our leisure to help in this excellent cause? Surely there must be some way in which every individual citizen in this country can help in this great and terrible crisis?

* * * *

Have not all of us who know Immingham, near Grimsby, considerable sympathy with the Rector of that place, who pleaded at a recent inquiry held there for the construction of a new road from Immingham to Grimsby? Is it not a fact that Immingham, which is growing rapidly in importance owing to the extensive docks and other works, is almost entirely cut off from the world owing to there being no road, apart from a very circuitous route?

* * * *

Were not those of us who attended the recent Brighton meeting of the Royal Sanitary Institute much struck with the appearance and condition of the surface of the road on the front known as Madeira-drive? Does not this roadway bear excellent testimony to the value of the material used when we know that it was laid about ten years ago, and has since received very little, if any, repairs? Cannot many of us remember the grave doubts that were expressed as to the wisdom of employing this then comparatively new material?

* * * *

Why is it that in some districts where housing schemes are badly wanted nothing is done, and that in others where the necessity is not at all obvious there is considerable activity in this direction? Is it not probably the "personal" element which looms so largely in all human transactions? May not the activity in the one case be generally traced to either a member or officer of the council who has "housing on the brain," while in the other case there is no one to take up the matter, and recreation grounds, or wider streets, may be the fashionable craze.

* * * *

Why was it that the district meeting of the Institution of Municipal and County Engineers was held at Bognor on the same day as an institution council meeting in London? Does the council in any way control or fix the dates of the district meetings, or are these held quite independently of the main controlling body?

* * * *

What is the real reason that has influenced the Metropolitan Commission of Police in refusing to issues licences to women to act as tramcar conductors? Is it not a fact that there are hundreds of women successfully acting in this capacity at Glasgow and elsewhere, and are not the women of the great Metropolis as physically and mentally fit to take up this work as the women in the provinces? Is it fair to the men themselves that they should be subjected to public criticism for doing work which could be done by women, when the fault does not rest with them?

* * * *

Is it not to be hoped that the withdrawal from the Road Board of the income derived from the motor spirit tax will not affect the very useful activities of that body, and that, at all events, this curtailment of income will only be temporary? Pending the resumption of activities, could not the staff of the Road Board be very usefully employed in the preparation of statistics from information in their possession as to methods and costs of road construction and maintenance, &c., which would be of priceless value to engineers and others if collated and published?

FOR OTHER ADVERTISEMENTS

See End of Paper.

CHERTSEY RURAL DISTRICT COUNCIL.

APPOINTMENT OF STEAM ROLLER DRIVER.

The above Council invite applications for the appointment of a competent Driver for their Steam Roller. Applicants must be experienced Drivers, with a thorough knowledge of Steam Rollers and Road Rolling. Wages, 35s. per week.

The person appointed will be required to act under the direction of the Surveyor, and must be willing to do other work when not engaged in rolling.

Applications, in candidate's own handwriting, stating age and experience, present and previous appointments, accompanied by copies of three recent testimonials as to experience and character, and endorsed "Roller Driver," must reach the undersigned not later than 12 noon on Monday, the 11th day of October, 1915.

C. G. ATKINSON,
Engineer and Surveyor.

Surveyor's Office,
Station-road,
West Byfleet. (2,730)

BOROUGH OF KINGSTON-UPON-THAMES.

PRESS CLOTH.

The Corporation invite Tenders, not later than the 13th October, 1915, for about 4,000 yds. of Press Cloth for their Sewage Works, according to the Specification to be obtained of the Borough Surveyor.

HAROLD A. WINSER,
Town Clerk.

Municipal Offices,
Kingston-upon-Thames.
September 29, 1915. (2,729)

BOROUGH OF KINGSTON-UPON-THAMES.

SULPHURIC ACID.

The Corporation invite Tenders for the Supply during the ensuing twelve months of about 300 tons of 80 per cent Sulphuric Acid for their Sewage Works.

Further particulars and Forms of Tender may be obtained of the Borough Surveyor, Mr. R. Hampton Clucas, at the Municipal Offices.

Sealed Tenders, endorsed "Sulphuric Acid," to be delivered at this Office not later than Wednesday, the 13th October, 1915.

The lowest or any Tender will not necessarily be accepted.

HAROLD A. WINSER,
Town Clerk.

Municipal Offices,
Kingston-upon-Thames.
September 29, 1915. (2,728)

BOROUGH OF MALDON.

The Town Council invite Tenders for providing and laying 245 lin. yds. of 6-in. Cast-iron Water Main in Station-road.

Specification of the work may be seen, and Form of Tender obtained on application to Mr. T. R. Swales, M.INST.C.I., Borough Engineer.

Tenders, endorsed "Tender for Water Main," are to be delivered at the office of the undersigned not later than 5 p.m. on Monday, October 18th, 1915.

The Town Council does not bind itself to accept the lowest or any Tender.

F. H. BRIGHT,
Town Clerk.

Municipal Offices,
Maldon.
September 27, 1915. (2,731)

STEAM ROLLER DRIVER seeks job, District Council preferable; excellent references.—Apply Box 1,542, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (2,732)

Public Water Supplies.

By PERCY GRIFFITH, M.Inst.C.E., F.G.S., F.R.San.I.

[For permission to reproduce the following matter, which was delivered in the form of a lecture recently, before the members of the Birmingham University Engineering Society, we are indebted to the courtesy of the Society of Engineers, to which the first-named body is affiliated. The first portion of the lecture appeared in our issue of last week.

Although there are many other points of interest connected with schemes for gravitation or upland supplies I must now turn to the more varied and no less interesting subject of

Surface and Underground Supplies. Although complete statistics are not yet published relative to the quantities of water obtained in this country from surface and underground sources respectively, I have no hesitation in saying that as regards water used for public supply purposes, the quantity obtained from underground sources is at least equal to that obtained from surface sources, and as a considerable proportion of the latter is pumped there is little doubt that the public supplies obtained by pumping far exceed in amount those obtained by natural "gravitation." (I use the prefix "natural" here because all public supplies are ultimately distributed by gravitation, and in this case I refer to those which do not require to be artificially raised by pumping.

In dealing thus broadly with the whole question I must not fail to mention a class of supply which is, strictly speaking, derived from underground sources, but which is, nevertheless, often supplied by "natural" gravitation. I mean those supplies obtained from natural springs at a sufficient height to gravitate to the area supplied. In many villages and rural areas sufficient water is obtained in this way to provide the relatively small demand which exists in such cases without either pumping or storage. Such schemes are not of sufficient importance to warrant any lengthy description here.

As I have already indicated, the variety of sources other than upland gathering grounds is almost endless; and the water engineer—at any rate, the consulting engineer who professes to advise under all circumstances—must acquire a more than casual acquaintance with the science of geology, particularly hydro-geology (as distinguished from palæontology, or the study of fossils).

The flow of water through the various strata composing the external skin of the earth affords material for careful study, and, by its very variety, will be found extremely fascinating, even apart from the question of water supply. The relative permeability of the surface and subsoil is a matter of vital importance to the farmer or student of agriculture, and it is this factor which affects so largely the nature of the vegetation indigenous to different areas, and the varied beauties which the student of Nature will find almost anywhere in this island of ours; indeed, of all the influences which have contributed to make the world beautiful, that exerted by the flow of water is probably the most striking and the most conspicuous and universal in its effects.

Should you ever have the opportunity (as I have had) of making a general topographical survey of a district with an experienced geologist, do not hesitate to take it. You will find delight in observing the (apparently magical) skill with which he will identify the succession of permeable and impermeable strata merely by noting the nature of the vegetation, and trace from a line of springs the outcrop of a permeable bed overlying an impermeable one. Indeed, no study will contribute more to make the wonders and beauties of Nature apparent—and thus to provide unexpected pleasure in the observation of the most ordinary physical and natural phenomena—than that of hydro-geology.

The water engineer will, however, have to carry his investigations far beneath the superficial beauties of the landscape, and, having identified the surface conditions at the outcrop of the water-bearing strata, to trace the progress of the precious element in its adventurous career underground. Comparatively little practical experience will prove that the phrase "adventurous career" is by no means misapplied in the present case.

While presenting evidences of remarkable uniformity in its formation, the earth's crust is distinguished, like its surface, by its want of uniformity; and this it is which provides intense interest in the one case as it provides entrancing beauty in the other. There is no water beneath the surface which has not found its way there by percolation from the surface, and every stream of underground water can be traced to the surface, as definitely as every surface spring can be traced to its source.

The next point of importance connected with underground water is that the flow through permeable strata is governed by the slope or configuration of the impermeable beds above and beneath; thus, in tracing the section of a water-bearing stratum, it is most necessary to trace also the relative depth, inclination and homogeneity of the strata forming, as it were, the bed of the underground stream and the roof of the underground reservoirs, as these govern the level at which water will be found, and that to which it will rise when tapped.

Now, varied as are the conditions provided by the juxtaposition of the various strata, much greater variety still is provided by the variable character of the permeable beds from which water is usually obtained.

The most prolific sources of underground water supplies in this country are—(1) The chalk; (2) the new red sandstone (bunter beds); (3) the oolitic limestone; (4) the lower greensand.

They present great diversities in regard to the conditions most favourable to the finding of water. Thus, chalk is almost impervious as regards its bulk, and water can only be abstracted by tapping fissures. The fissures are, however, large and abundant in most cases, except where the chalk is overlaid by a great thickness of (London) clay. The new red sandstone is, on the other hand, characterised by bands of pebbles, through which water will flow freely. Oolitic limestone is somewhat similar to chalk, except that it is more freely fissured, and therefore more favourable as regards obtaining a good supply of water at any given point. The greensand is, on the contrary, of a more homogeneous character, and water can be drawn freely if a certain amount of sand is allowed to pass with the water. The many other less important water-bearing strata present similar varieties, and it will be seen that, in designing large works for the supply of towns, it is vitally important that the method of collecting the water should be adapted to the peculiar character of the beds from which it is to be obtained. (This point is, of course, of less importance in dealing with small supplies to single houses or to public institutions.)

The design of underground works is therefore a matter requiring much consideration and, particularly, extensive experience, and I may here justify my reference to "gravitation schemes" as being of a comparatively simple character. In every case the engineer has a certain number of conditions presented to him, among which a certain proportion are unknown and subject to more or less reasoned speculation. Now, however speculative may be the conditions governing the water supplies in upland gathering grounds, those involved in problems of underground water are infinitely more so, and the proportion of unknown factors is enormously greater; nothing, therefore, but extended experience (including many failures) can qualify an engineer to advise on questions of underground water supply. At the same time, no subject is more fascinating to one with sufficient energy, determination and patience to carry him through the initial difficulties and disappointments which are the essential preliminaries of a successful practice.

Broadly speaking, underground waterworks may be classified as follows: (1) Shallow wells for tapping subsoil water; (2) deep wells for tapping deep-seated reservoirs; (3) wells with artesian borings to tap deep-seated streams; (4) borings (either with or without chambers or wells to take the pumps).

(1) *Shallow Wells for Subsoil Water.*—In the first of these the greatest difficulty to be provided against is the pollution of the water, and it is important

[illegible] should be made perfectly watertight [illegible] depth it may be necessary to filter out [illegible] at the surface. The water will [illegible] to the well until a [illegible] through [illegible] about depth of the shoot to [illegible] depth will vary according [illegible] the [illegible] the character of the [illegible] which water is obtained [illegible] collected in surface gravel beds by means of drain pipes laid with open joints, but unless the area drained by this method is care- [illegible] from pollution at the surface, [illegible] collecting tanks, intended for domestic use.

[illegible] to line the shaft of brick or stone wells [illegible] and the most expensive being to line them with cast-iron cylinders, which can be cast in rings up to 4-ft. diameter, but beyond this size are best made in segments with vertical joints. The vertical flanges are, of course, useful and [illegible] in this case as stiffeners. Cast-iron cylinders are, however, more generally used in deep wells, and their application will be more fully described under that head.

The more common method of making shallow wells watertight is to line the excavation with a single ring of brickwork (in some cases specially moulded bricks being employed), and to pack the space behind with concrete. The face of this ring is then rendered with cement mortar about 1 in. thick, and another ring of brickwork is then built up as a protection to the mortar. As brickwork must be built upwards, it is necessary in such cases to suspend in the well a temporary ring or kerb on which the brickwork is supported until the packing behind provides sufficient bond to prevent it slipping down the well. In cases where the sides of the excavation are liable to fall in, it is necessary to fix a temporary lining of timber, which is removed as the brickwork proceeds. It is also better to erect the brickwork in sections rather than to rely upon timbering for any great depth.

Watertight work can also be obtained by laying a two-brick ring in one operation with cement mortar joints and backing, but the former method is generally preferred.

(2 and 3) *Well Earth or without Borings.*—In deep wells the chief difficulties arise through the variations of strata passed through. Thus a narrow band of [illegible] will make it almost impossible to carry out the lining in brickwork; indeed any sandy or loose strata will involve difficulties in supporting the excavation while brickwork is built up. In such cases cast-iron or wrought-iron cylinders are used, and these must be driven down from above. The tendency of the surrounding material to close in behind the cylinders will sooner or later make it impossible to force the cylinders down beyond a certain depth, and at that point cylinders of smaller diameter must be inserted inside the upper section until in turn these become fast, when a further reduction of diameter must be made. Should a solid bed of clay be subsequently met with, it is possible to resume lining with brickwork, and in that case the diameter can be increased to provide facilities for fixing pumps and space for giving access thereto.

I have separated wells tapping underground reservoirs from those having borings carried down from the bottom, because they apply to different geological conditions. In the former case the water does not rise when tapped, as it has no "artesian" head, and the well is merely carried down into a reservoir such as would exist where it was sunk wholly through the water-bearing stratum from which the supply is to be derived. In chalk it would probably be necessary to drive adits or headings longitudinally in order to secure any large quantity of water, as a well of any ordinary dimensions would not be likely to intersect a sufficient area of fissures to collect any large volume of water.

In the second case (wells with borings) the well is merely constructed to enable the pumps to be fixed below the water level, and the water is tapped by means of a boring driven from the bottom. This arrangement is applicable only where the water is under an "artesian head"—that is, when it is tapped below the "line of saturation," and therefore rises up the boring when the superincumbent impervious bed is perforated.

A [illegible] of this kind of well was carried out by me for the Lincoln Corporation; the well was carried down in impervious clay to a depth of 1,500 ft., and at 1,560 ft. the boring (which was ultimately carried to a depth of 2,020 ft.) tapped water, which immediately rose up the well until it overflowed at the surface.

(4) *Borings.*—It will be realised that in sinking wells in water-bearing strata it is necessary to pump out the inflowing water continuously to enable the men to excavate the material and construct the lining. This frequently constitutes a large item of expense, and it is then necessary to consider the alternative of boring, a process not only less costly and quicker than well-sinking, but one which is carried out entirely from the surface, thus avoiding the risks of accident inseparable from work underground.

The head gear used in sinking the well and driving the boring at Lincoln, already referred to, is known as Mather & Platt's machine. The essential feature of this apparatus is the use of a flat hemp rope for suspending the boring chisel, and raising and lowering the "shell." This rope is wound on a drum which is operated by an engine fixed on the rear framework of the machine. The process of boring consists of two distinct operations; the first is the reciprocation of the boring chisel, which was in this case 24 in. in diameter when the boring was at its greatest depth (2,020 ft.), and consisted of a circular disc of steel perforated with holes in which are bolted a number of steel chisels, the disc being suspended at the end of a steel rod or vertical shaft about 12 ft. long and from 5 in. to 6 in. diameter, on which a skeleton disc is fixed near the top to form a guide. During this operation the drum is fixed in a stationary position, and the rope is clamped to the frame of the machine so that the chisel will just reach the bottom of the boring. The rope is passed over a pulley fixed on the upper end of a ram working in a vertical steam cylinder so that the admission of steam to this causes the pulley to rise, carrying the rope and suspended chisel with it. When this has been raised a certain height (depending on the nature of the strata being bored through) the steam is released, and the weight of the chisel (this one weighed several tons) carries the rope, shaft and tool to the bottom with a force proportional to the amount of "fall" allowed. This operation is continued for periods varying with the progress of the boring—that is, until sufficient material has been excavated to impede the working of the chisel.

The drum is then operated to wind the rope and chisel to the surface, the chisel is detached, and the "shell" substituted. This is merely a large steel cylinder fitted with a hinged bottom opening inwards. This is lowered to the bottom and reciprocated for a few minutes, after which it is drawn rapidly—that is, much more rapidly than the boring chisel—to the surface, and its contents discharged into wagons for removal to the tipping place. This is repeated until the foreman in charge is satisfied by the feel of the rope that the loose material has been removed, when the chisel is again lowered, and the cycle of operations is resumed as described.

Although this description applies to a boring of rather unusual dimensions, the process adopted is that in most common use for deep borings, except that the flat rope enables the chisel to be automatically revolved at each stroke, whereas when ordinary circular rope is used the tool has to be revolved by manual labour. For smaller borings steel rods are used in place of ropes, but these have to be lifted in sections, unscrewed, and slung aside every time the tool is raised for "shelling" out the débris, and replaced when the "shell" or chisel is lowered.

As the boring proceeds it is necessary to drive down steel (or, in some cases, cast-iron) tubes to prevent the sides from falling in, and, as in the case of well cylinders, these will sooner or later become jammed by the closing in of the surrounding strata. When this occurs it is necessary to insert a line of tubes of smaller diameter, and in some cases a considerable number of such reductions is necessary before the full depth can be attained. As the work proceeds each separate line of tubes must be provided of the full depth of the boring, so that it can be forced down from the surface, but on the completion of the work each section of tubing can be cut off at such a point as will provide a lap of about 20 ft. in the next larger section. If, however, there is any risk of polluted water passing through the junction into the boring, the inner and smaller lining tubes must be left in for the full depth.

PUMPING MACHINERY.

It will have been observed that, although my second division of water supply schemes was headed "Surface and Underground Supplies," I have as yet said nothing about surface supplies. The reason is

[illegible] works of this character involve no special problems other than the design of the pumping machinery and the question of filtration (which I cannot [illegible] at my disposal.

As the question of pumping machinery is a [illegible] of mechanical engineering, and to that extent lies somewhat outside the sphere of the civil engineer, it is hardly possible for the water engineer with a general practice to master thoroughly all the details involved in the design and construction [illegible] pumps and their accessories. The engineer in charge of works where pumping machinery is [illegible] have, however, duty to be often [illegible] the special elements of the plant, and he will, by virtue of his responsibility for the [illegible] of the plant, be compelled to master thoroughly the details of the machinery under his care. As, moreover, he will at intervals be called upon to advise as to the extension, removal, or improvement of the plant at his works, he must keep himself thoroughly up to date as regards the relative efficiency or other advantages or disadvantages of different designs of pumps and motors for operating them. The consulting engineer, having possibly no works under his constant supervision, [illegible] collecting experience and information as to the results obtained with various types of plant under different working conditions. For all alike it is extremely desirable that the early training should include service in the shops of a firm manufacturing pumping machinery, as by no other means can the mind be educated to that intuitive grasp of mechanical problems which is essential to secure independence of judgment. Without such training it is also very difficult, if not impossible, effectively to superintend work carried out by such firms, and such inexperience must be paid for, directly or indirectly, by the employer or client.

As there is almost endless variety in the types of pumping plant in use for waterworks, it is out of the question for me to do more than briefly outline the main sub-divisions into which the subject may be classified.

Broadly, these are:—

(1) Surface pumps (low and high lift).

(2) Well pumps.

(3) Borehole pumps.

And for motive power:—

(*a*) Steam engines (direct acting or geared).

(*b*) Internal combustion engines (gas or oil).

(*c*) Electric motors.

(*d*) Air lift (including compressing plant).

(*e*) Water wheels and hydraulic motors.

[illegible] For low lifts and proportionately large deliveries, the single centrifugal pump is very convenient, mainly on account of the absence of valves and the high speed at which they are run, thus allowing them to be coupled to high-speed motors without the interposition of gearing. It is, however, rarely the case that waterworks can be supplied by low lifts, and the application of this type of pump is therefore very limited.

Another special pump suitable for low lifts is the "Humphrey" internal combustion pump, of which a very striking example is at work at the new Chingford reservoir of the Metropolitan Water Board. This is a combination of engine and pump in one piece without pistons, buckets, gearing, or any close-fitting parts whatever. It operates by a cycle similar [illegible] Otto cycle—that is, (*a*) the explosion chamber is charged with the proper proportion of air and oil vapour drawn in (in this case by the movement of a body of water), (*b*) the mixture is compressed (in this case by the return movement of the water), (*c*) the explosion of the mixture expels the water and elevates it to the point of discharge, and (*d*) the explosion chamber is swept clear of the products of combustion (again, by the pendulum-like action of water).

For high lifts the plunger pump is most suitable, as this lends itself to any variety of conditions, both as regards space occupied, position (horizontal, vertical or inclined) and type of motive power. The [illegible] pump may be applied to any case where the pumping level of the water is within 25 ft. (vertically) of the surface, as under such circumstances the pump itself can be fixed on the ground level.

(2) *Well Pumps.*—In three-throw bucket-and-plunger pumps, suitable for fixing in wells at depths of from 20 ft. to [illegible] below the surface the pumps are operated by steel rods carried in suitable guides fixed to the side of the well, the reciprocation being given by a crank shaft with three cranks set at an angle of 120 deg. to one another. The delivery of water is thus almost constant throughout the revolution, and this type of pump is very popular on account of the absence of shock in the rising main due to the valves.

(3) *Borehole Pumps.*—Where it is decided to dispense with a well, it is, of course, necessary (unless the pumping level of the water is within 25 ft. of the surface) to fix the pump in the boring. This limits the design of the pump to two types—viz., the single-acting bucket pump and the "connecting pump" (double acting).

One modern development of borehole pumps must be briefly mentioned, and that is the multiple-centrifugal pump. This consists of a series of centrifugal pumps revolving on a common axis or shaft. The water passed from the outlet of one to the inlet of the next acquires an increased pressure at each stage, and by this method high-speed engines or electric motors can be applied to this type of plant without the need for casing of extravagant proportions.

VARIOUS TYPES OF MOTIVE POWER.

This subject is extremely fascinating, because it involves so many points which interact upon one another and which, considered separately, may produce results altogether contrary to those which result from the combination of all. This may be best illustrated by a brief reference to the various types I have enumerated.

(*a*) *Steam Engines* are even yet the most reliable machines for driving pumps, and in large installations the fuel economy obtained with them compares favourably with that obtained with any other more modern system. In cases where, owing to the gradual falling off of the yield of water, it is desired to run the pumps at slow speeds, the steam-driven pump is the only one which will meet the case economically and efficiently.

(*b*) *Internal Combustion Engines* offer the greatest attraction in regard to fuel economy and first cost, and for small work they must be considered as generally the most suitable. Gas engines operated by independent producer-gas plants give remarkable results as regards fuel economy, and although this advantage is somewhat discounted by the stand-by losses and the cost of maintenance, experience has now proved the system to be very well adapted for small waterworks.

The oil engine has also proved a very convenient motive power for small rural works, as the supervision required is reduced to a minimum, but in recent years the invention and development of the Diesel engine has given this type of power an advantage over other internal-combustion engines. The fuel economy has been greatly increased, and the larger sizes of plants have given results which bid fair within a short time to exceed those obtained with every other type of plant. (The application of this system to marine propulsion will no doubt be known to all present.) Nevertheless this, like every other internal-combustion engine, must be run at high speeds, and for this reason it is not applicable to the ordinary types of pump, except by means of elaborate systems of gearing, which, by their cost, friction losses, and excessive wear and tear, largely discount the initial advantages offered by the engine.

(*c*) *Electric Motors* are, of course, often applied to pumps, but, except with centrifugal pumps, their high speed involves the use of gearing, and unless electricity is available at very low cost, or other power is not available, electric motors are not often employed for pumping.

(*d*) *Air-lift Plant.*—This is a very convenient method of raising water from deep borings, particularly for temporary purposes, such as testing the yield, or removing accumulated sand and débris. It has the advantage of dispensing with valves and working parts in the borehole. It is also convenient in cases where water has to be drawn from a number of borings in the same neighbourhood, for a central power station can provide compressed air sufficient for all, and so avoid the establishment of a separate works at each boring. It has, however, the disadvantage that the average fuel cost is about three times that of any other type of pumping machinery; moreover the air pipe must be immersed to a depth below the pumping level almost equal to the height to which the water has to be lifted, thus the boring must (in many cases) be carried to a depth much greater than otherwise required.

(*e*) *Water Wheel and Hydraulic Motor*, excluding

therein turbines are occasionally convenient methods of operating pumps, particularly in cases where pumping stations are situated adjacent to large rivers. Examples can be seen at Reading, Windsor and Guildford, but this type of motor is better suited to countries where water power is more liberally provided by Nature than it is in the United Kingdom, and in such cases it is usually found more economical to utilise the water power for generating electricity, which in its turn can be applied to all industrial purposes with almost equal facility.

CONCLUSION.

It would have been very interesting to have considered many other important branches of the water engineer's work, such as the design and execution of the conduits or pipe lines conveying water from distant watersheds, and the varieties of modern practice in the design of service reservoirs in connection with which reinforced concrete now plays so important a part; there is also a vast field for research in chemical analysis and bacteriological examination of water, the detection and prevention of pollution, the filtration and softening of water, and problems connected with the distribution of water supplies, the prevention of waste, and the supply of water for fire extinguishing, but I have thought it best to select a few more elementary problems and treat them in some detail rather than to cover more ground in a very summary manner. I shall, however, be content if what I have said is of sufficient interest to induce you to investigate these other matters for yourselves as opportunity offers.

MUNICIPAL HOUSING AT NEWCASTLE-UNDER-LYME.

The completion is reported by the *Staffordshire Sentinel* of twenty-nine workmen's dwellings, arranged in three blocks, which the corporation of Newcastle-under-Lyme started shortly before the outbreak of war. The scheme has been carried out by Mr. A. A. Pattison, the borough surveyor, from plans prepared by Mr. Frank Emery. The site on which the houses have been erected is the property of the corporation.

The accommodation comprises a living-room 13 ft. 6 in. by 12 ft. 3 in., a scullery 11 ft. 6 in. by 8 ft., and pantry, and three bedrooms 13 ft. 6 in. by 11 ft., 11 ft. by 9 ft., and 8 ft. by 6 ft. The outdoor appointments include a water-closet, a covered recess for the refuse bin and coal-house. The back streets are sett-paved.

The estimated receipts from the property are as follow:—

INCOME.	£	s.	d.
11 houses at 4s. 9d. per week	135	17	0
1 house at 4s. 6d. per week	11	14	0
16 houses at 5s. 6d. per week	228	16	0
1 house at 5s. 3d. per week	13	13	0
Total	£390	0	0
Less 3½ per cent allowance for voids	13	13	0
Net total ...	£376	7	0

ESTIMATED OUTGOINGS.	£	s.	d.
Annual repayment of loan, principal and interest, without reduction of income-tax, at 4 per cent, in respect of buildings, £5,050 for 60 years ...	186	17	0
Ditto in respect of sewers and street works, £290 for 20 years	20	11	10
Rates at 8s. 9d. in the £	72	11	5
Taxes	40	0	0
Insurance	3	13	6
Water charges, if borne by local authority ...	15	7	0
Allowance for maintenance and repairs	39	0	0
Supervision and collection of rents	19	0	0
Total	£397	0	9

Local Government Loans.—Replying to a question in the House of Commons last week, the President of the Local Government Board stated that the amount of loans sanctioned by the board during the period March 26 to August 31, 1915, was £2,091,402, and during the same period in 1914 was £7,412,277. During the financial years ended March 31, 1913 and 1914, the loans sanctioned were £12,795,285 and £15,178,255 respectively. He should like to add that of the £2,091,402, over £1,350,000 was for war requirements—such as the provision of electrical and gas power, housing for munition workers, hospitals, and so forth.

EQUIPMENT FOR HIGHWAY WORK.*

By Arthur H. Blanchard,
Professor of Highway Engineering, Columbia University.

Fundamentally, the problem of the selection of economical and efficient plant equipment is the same for the highway departments of states, counties and municipalities and contracting companies. The selection of equipment for the construction and maintenance of highways should be based upon a consideration of the following factors: (1) Character of work; (2) specification requirements covering plant equipment; (3) amount of work; (4) portability of plant; (5) large and small units; (6) ease of manipulation; (7) adaptability to different classes of work; (8) funds available; (9) depreciation of plant; (10) transportation facilities. The practical necessity for the consideration of many of the above factors is self-evident.

Where a contractor's work covers the construction of all the various types of roads and pavements used in a municipality, county, or state, the selection of the several units of plant equipment should be based upon their adaptability to different classes of work. For example, where cement-concrete pavements as well as concrete foundations are to be constructed, in many cases a type of mixer should be purchased which is satisfactory for the construction of pavements, the requirements for which are more specific than in the case of mixers used only on foundation work.

In the modern practice of highway engineering many specifications include specific stipulations which must be met by machines and accessories employed. As illustrations might be cited the weight of rollers, pressure limitations in distributors, grouting apparatus, and details of mixers for the manufacture of bituminous concrete.

It is evident that a contractor or a department will be justified in the purchase of an ideal equipment if the work is to be extensive in character. If the work is centralised and large in amount, in many municipalities a large, well-equipped permanent plant will prove economical. If, on the other hand, the work is large in amount, but distributed over considerable area, small portable units will prove more satisfactory, as in the case of mixing plants for the manufacture of bituminous concrete.

In cases where contractors are engaged in general highway work, and their organisation does not include foremen who are specialists in the manipulation of various types of complicated machinery, it is of the utmost importance that simplicity of machines and ease of manipulation should be given great weight in the selection of equipment. This is particularly true in connection with various types of machines used in the construction of bituminous surfaces, bituminous macadam and bituminous concrete pavements.

It is well known that specifications for different classes of work, requiring the same type of machine, call for differences in detail. For grading work specifications might require rollers weighing from 12 to 15 tons, while in the construction of wearing courses of some types of pavements a 10-ton to 12-ton roller is stipulated. A contractor who is handling a small amount of general highway work would therefore find it advantageous to purchase a 12-ton roller suitable for both classes of work mentioned above.

Departments and contractors are necessarily forced to consider first cost of equipment, as the funds available may not permit the installation of the most economical and efficient machines. In many cases where such conditions are encountered it is obvious that it will not be practicable to anticipate that the work can be accomplished with the same degree of rapidity and at the same cost as if more efficient machinery constituted the plant equipment.

Depreciation charges on plant equipment should be given careful consideration prior to the purchase of machines and accessories, as well as in the consideration of the cost of highway work.

Facilities for the transportation of machinery and materials materially affect the efficiency of the several units of plant equipment. For example, in municipalities, counties and states where materials may be transported over highways in good condition, the use of the motor truck will usually be found desirable.

* From a paper presented at the Pan-American Road Congress at San Francisco on September 16th.

MUNICIPAL TRAMWAYS ASSOCIATION.

ANNUAL BUSINESS MEETING IN LONDON.

The annual business meeting of the Municipal Tramways Association took place at the Surveyors' Institution on Friday last, Alderman H. Linsley, J.P., chairman of the Salford Corporation Tramways Committee, the retiring president, occupying the chair.

The annual report of the executive committee, which was submitted in the course of the proceedings, stated that the total membership of the association was now as follows: Honorary member, 1; [illegible] 76; managers and assistants, 111

MOTOR-OMNIBUS TRAFFIC.

The report mentioned that the sub-committee appointed to deal with the matter of motor-omnibus traffic and road maintenance in consultation with the association's London agents had had a preliminary conference with representatives of the Association of Municipal Corporations for the purpose of discussing certain broad principles, and a report would be submitted later. The question of giving evidence before the expert committee on heavy motors and locomotives had also been considered, and an interview had taken place with the secretary of the committee with a view to ascertaining whether it was desirable for the association to submit evidence. The secretary to the committee intimated that that body would be prepared to have any relevant evidence on the matter from the association, but that if the evidence was merely a repetition of that which had already been received from many sources, to the effect that heavy motor-traffic did considerable damage to the roads, it would not assist the committee very materially. Inasmuch as the expert committee was not concerned with the main questions of principle so far as tramways were concerned, the sub-committee of the association had considered it inadvisable to submit evidence.

STANDARDISATION OF TRAMWAY RAILS.

The sub-committee of the Engineering Standards Committee on Tramway Rails considered (1) the revision of the standard tramway rail sections, (2) the revision of the standard specification for tramway rails, and (3) a report on British standard special trackwork for tramways. As regards the revision of the standard sections, the sub-committee proposed to recommend that the existing standard sections be replaced by three sections, with their corresponding curved sections, having a uniform width of head of 2⅜ in. It also proposed to recommend the adoption of a dwarf rail for inter-urban tramways. This rail was primarily intended for use with sleeper construction, had a 2¼-in. width of head, and weighed about 88 lb. per yard. A panel committee had been at work preparing recommendations for the revised analysis and mechanical tests for tramway rails. It had presented its report to the sub-committee, and the revision of the standard specification was being proceeded with. A report had been prepared on British standard special trackwork for tramways, dealing with the standard nomenclature of the different classes of special trackwork used in actual practice, and standard dimensions for crossings, switches, and turn-outs. This report was ready for presentation to the Sectional Committee on Rails.

TRAMWAY TYRES, AXLES AND SPRINGS.

The panel committee of the sub-committee of the Engineering Standards Committee on tramway tyres and axles had drawn up standard specifications for tramway tyres and axles. In the case of tramway axles the same course had been taken as was adopted in the railway rolling stock specifications, two specifications being drafted, one with and one without a chemical analysis, in order that those who did not desire to specify an analysis might have a standard specification available. Pending the confirmation of certain cold bend tests for axles, the specifications were ready for presentation to the sub-committee on tyres, axles, and springs. The council of the association was convinced that useful work was being done by the sectional committees of the Engineering Standards Committee, and it was therefore keeping well in touch with its activities.

RAIL CORRUGATION.

In order that the undertaking of experiments and the general investigation of the rail corrugation phenomena might proceed continuously, the general committee decided to appoint two sub-committees, one comprising the members in the north and the other those in the south, to undertake this work. A number of meetings had taken place during the year, and reports had been issued by the respective sub-committees, and duly submitted to the general committee. Additional experiments had been decided upon, and the sub-committees are continuing their investigations, preparatory to a further report on this subject.

The report was adopted.

THE ROMANS AS MUNICIPAL ENGINEERS.

TOWN PLANNING INSTITUTE PRESIDENT'S TRIBUTE.

The winter session of the Town Planning Institute opened on Friday evening last with a meeting at the offices of the Institution of Municipal and County Engineers, the president, Mr. Raymond Unwin, F.R.I.B.A., occupying the chair.

In the course of an address to the members Mr. UNWIN, after referring to the honour which the institute had conferred upon him in electing him as president, said he was convinced that the subject of town planning was one the importance of which in this country, as well as in all countries, was destined to grow. His belief was that the city itself would become a unit of vastly greater importance than it had been during the last century. So far as records existed, or remains of towns could be unearthed by excavation, they found evidences of town planning and of concentration on the expression of certain ideas or aspects of the subject. This concentration on the expression of an idea, coupled as it was with such perfection in the execution and adornment of the individual buildings, might be regarded as a sign of high civilisation far outweighing in importance the neglect of the geometric lay-out.

Perhaps the greatest contribution made by the Romans was in the construction of great works of public utility. It was as municipal engineers and great constructors that the Romans claimed special attention. In Rome it was this aspect of their work which specially impressed one. They seemed to revel in works of construction, and one found water supply carried for many miles across valleys on massive masonry aqueducts sometimes exceeding 100 ft. in height, and through the hills in tunnels bored through solid rock. The tendency to adapt the site to the scheme rather than to adapt the scheme to the site was a marked characteristic of much Roman work. Where the Greek would pile his temples one upon another on the rocky ledges, the Roman would cut away the hill and make for himself a level plateau upon which to carry out the massive order of his schemes. No constructional feats were too daring for the Roman city builder, and no amount of labour too great to satisfy the needs of the people, and he was prepared to go to any extent of magnificence in the adornment of these structures that would confer distinction upon them or serve to aggrandise those who were responsible for their erection.

In Rome, although only a certain amount of definite street planning was carried out—partly owing to the difficulty of the site, but mainly owing to the fact that a large part of the city was established before the great period of Roman construction set in—in other ways the organisation of municipal sanitation and of other municipal provision for social life and recreation reached a degree of perfection which had only been recovered, and in some respects had not yet been recovered, in the most advanced of modern cities. All through the intervening ages, while other phases of civic life were prominent in one great city or another, the great constructive provision which Rome made for its citizens seemed to have been as completely lost from human knowledge and experience as the refined perfection of the Greek artist. The modern city must hark back to the Roman Empire to find the lost precedent for many of its conveniences and luxuries. Many a town was proud of its public baths and wash-houses, but no modern city approached to the extent or magnificence of the provision made in Rome in that direction. The remains still existed of the great monumental buildings which were erected to accommodate the luxurious bathers, and which were still sufficient to astound us by their size, the daring of their construction, and the magnificence of their decoration.

SOCIETY OF ENGINEERS.

At a meeting of the Society of Engineers to be held at 7.30 p.m. on Monday next, at the Surveyors' Institution, Great George-street, Westminster, a paper, entitled "Law and Engineering," will be read by Mr. Sydney G. Turner, ASSOC.M.INST.C.E., barrister-at-law, the following being a synopsis:—

Introductory—Many subjects of common interest to the lawyer and the engineer—But no common meeting ground—Expert evidence—The engineer as arbitrator—The engineer and engineering contracts—Certificates — Municipal engineering and law—Problems of modern highway construction and traffic conditions—Sewerage and drainage—Private street works apportionments—Gas, water and electrical engineering—Legal aspects of all these branches of engineering work—Conclusion.

A. S. E. ACKERMANN,
Secretary

17 Victoria-street, S.W.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

STEAM ROAD ROLLER DRIVER.—October 4th.—Matlock Urban District Council. 30s. per week.—Mr. Joseph Turner, engineer and surveyor, Town Hall, Matlock.

GAS MANAGER. — October 11th. — Llandudno Urban District Council. £160—£200. — Mr. A. Conolly, clerk.

ASSISTANT ENGINEER. October 22nd. Water Department, Corporation of Sheffield. £300 per annum.—Mr. William Terrey, general manager, Town Hall, Sheffield.

ASSISTANT ENGINEER.—Southern Command, Salisbury. £2 10s. per week. Also linesman jointer (£2 10s.), fitter drivers (£2 10s.), fitters (£2), engine drivers (£1 10s.), and switchboard attendant (£1 5s.). Chief Engineer, Southern Command, Salisbury.

ENGINEERS.—The War Department require district electrical and mechanical engineers in connection with the military hutment camps electricity supply. £3 5s. to £4 per week.—Chief Engineer, Southern Command, Salisbury.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

YORK. — November 30th.—Schemes under the Housing and Town Planning Act, 1909, in connection with certain areas within and without the city of York, for the corporation. Premiums, £100, £50 and £25.—Mr. F. W. Spurr, city engineer, Guildhall, York.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

HALIFAX.—October 6th.—For the brickwork and concrete foundations required for two cooling towers, for the corporation.—Mr. J. Lord, borough engineer, Town Hall.

STANLEY.—October 6th.—For the extension of a brick culvert, for the urban district council.—The Surveyor, Stanley, Durham.

KILKENNY.—November 30th.—For the construction of a reinforced-concrete bridge, for the Kilkenny and Wexford County Council.—Mr. A. M. Burden, county surveyor, Kilkenny.

Engineering: Iron and Steel.

BATTERSEA.—October 2nd.—For the supply of iron bars, and tools, for three and six months, from September 30th, for the borough council.—Mr. W. Marcus Wilkins, town clerk.

PEMBROKE (Co. Dublin).—October 3rd.—For the supply and erection of a cooling tower, for the urban district council.—The Clerk, Town Hall, Ballsbridge.

LONDON.—October 5th.—For providing and fixing a heating and ventilating installation, for the county council.—Superintending Architect, Aldine House, Bedford-street, Strand, London, W.C.

SCUNTHORPE.—October 6th.—For the supply and delivery to Appleby Station of 400 lin. yds. of 9-in. cast-iron water pipes, for the urban district council.—Mr. Herbert Heap, engineer and surveyor, High-street, Scunthorpe.

LISTOWEL.—October 7th.—For improvement of the water supply, for the rural district council.—Mr. M. O'Connell, clerk.

BELFAST.—October 13th.—For (1) the supply of a new or second-hand bucket ladder hopper dredger, (2) for the hire of a dredger, and (3) for dredging the harbour, for the Harbour Commissioners.—Mr. T. S. Gilbert, harbour engineer.

BOSMERE AND CLAYDON.—October 14th.—For sinking a well, for the rural district council.—Mr. R. M. Cook, clerk, 20 Providence-street, Ipswich.

KILKENNY.—November 30th.—For building a bridge in reinforced concrete, for the County Councils of Kilkenny and Wexford.—Mr. A. M. Burden, county surveyor, Kilkenny.

Roads.

BRAINTREE. October 2nd.—For steam rolling and scarifying, for the rural district council.—Mr. C. V. Bright, surveyor, London-road, Braintree.

KESTEVEN.—October 9th.—For the supply of granite, slag chippings and rejections, and gravel, for the county council.—Mr. W. B. Purser, county surveyor, Grantham.

OSWALDTWISTLE.—October 9th.—For making up a road, for the urban district council.—Mr. R. N. Hunter, surveyor.

HASTINGS.—October 9th.—For the supply of 1,000 yards of best unbroken bluestone, for the rural district council.—Mr. J. Standen, district surveyor, Ivy House-lane, Ore, Hastings.

WARRINGTON.—October 11th.—For the supply of 600 lin. yds. of dressed kerbs, for the corporation.—Borough Surveyor.

SHEERNESS.—October 19th.—For the supply of basalt or broken granite, Kentish ragstone, and clean, dry hoggin, for the urban district council.—Mr. T. F. Berry, surveyor.

BEDLINGTON.—For the supply of 5,000 tons of hand-broken road whinstone, for the urban district council.—Mr. J. E. Johnston, surveyor.

Sanitary.

AUCKLAND. October 4th. For providing and laying 205 yds. of 9-in. glazed earthenware pipe sewer, with manholes, for the rural district council. Mr. J. T. Robson, sanitary surveyor, 9 Cradock-street, Bishop Auckland.

GOOLE.—October 9th.—For the scavenging of Rawcliffe and Rawcliffe Bridge, for the rural district council.—Mr. C. H. Coggrave, clerk, 4 Belgravia, Goole.

WIGAN.—October 11th.—For the supply of 500 galvanised sanitary pans, for the corporation.—Mr. W. H. Tyrer, town clerk.

BLAYDON.—October 12th.—For the removal of contents of ashpits, for the urban district council.—Mr. R. Biggins, Council Offices, Blaydon-on-Tyne.

SUTTON-IN-ASHFIELD. — October 30th. — For alterations to existing sewage tanks, the construction of new screening chamber, settling tanks, rectangular bacteria beds, humus tank, engine-houses, office, and other incidental works, for the urban district council.—Messrs. Willcox & Raikes, 63 Temple-row, Birmingham.

Miscellaneous.

LISTOWEL.—October 7th.—For the improvement of the water supply, for the rural district council.—Mr. M. O'Connell, clerk.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. OCTOBER 8, 1915. No. 1,238.

Minutes of Proceedings.

The Case for Town Planning.

Town planning plays so important a part in the social and economic development of our towns and cities that all engaged in municipal work will welcome the publication of a new book on this subject* by such a well-known authority as Mr. Aldridge, the secretary of the National Housing and Town Planning Council. "The Case for Town Planning" is a work encyclopædic in character, and deals with this complicated subject in a very comprehensive manner. The historic development of our towns is traced from the earliest times to the present day, though this is done with commendable brevity. The ancient Greek and Roman cities with their wealth of architectural and engineering skill; the walled and fortified mediæval towns with their picturesque, if insanitary and over-crowded houses, and narrow and tortuous streets; the Renaissance cities of Italy with their stately palaces and fine squares; and the development on these lines of town planning as seen in London, Edinburgh, and Bath, and the more modern cities of Paris, Berlin, and Brussels, coming down to the movement for garden cities in our own day, are all briefly dealt with in the first part of the book. The necessity for better housing and improved social conditions, which have formed the theme of so many of our novelists, from Kingsley in "Alton Locke" to Wilson with "No. 5 John Street" is strongly emphasised by Mr. Aldridge. Though the various Public Health and Housing Acts have done much to improve the sanitary conditions of our towns and workmen's dwellings, it may be safely said that it was not until the passing of the Town Planning Act of 1909 that local authorities were given the power to lay out and develop their towns on right lines, and to make provision for the amenities of the workers in our industrial towns in the shape of open spaces, parks, and recreation grounds.

The trouble and expense of improving the narrow and congested streets in nearly all our large towns, and the difficulty experienced in preventing the perpetuation of these conditions, was a matter of deep concern to all municipal authorities. It is to the method of preventing this in the future, and to the working of the Town Planning Act, that Mr. Aldridge devotes the second part of his book, and as he has had the benefit of the experience and advice of Messrs. Elgood and Abbot, who are so well known for their work in pioneering the Ruislip-Northwood town planning scheme, this portion of the book is particularly valuable to municipal engineers and surveyors. A work of this character is necessarily largely a matter of compilation, and though many of the illustrations and schemes have already appeared in this and other journals, it is extremely useful and convenient to have collected in one volume such a large amount of information on this important subject. There is a little overlapping in places, and one could have wished that the subject had been dealt with more fully on the artistic and ideal side by reference to the work of men like Adshead, Burnham, Mawson and Thompson. On the other hand, no other work treats so fully the social and legal side of the subject. The reference to the Ruislip-Northwood scheme, and the details of the important work carried out at Birmingham by Mr. Stilgoe, and at Liverpool by Mr. Brodie, will be of special interest to all engineers and surveyors who may be called on to prepare a town planning scheme. The book is not only very valuable as a work of reference, but will be almost indispensable to those students who propose to sit for the examination in town planning held by the Institution of Municipal and County Engineers.

* By Henry F. Aldridge, with an appendix by Frank M. Elgood, F.R.I.B.A., and Edmund R. Abbot. Price 15s. nett. London: The National Housing and Town Planning Council.

* * *

The Computation of Rainfall on Gathering Grounds.

Many years must necessarily elapse before anything approaching complete knowledge of the average rainfall over the whole of this country is possible. A continuous record of rainfall observations covering every district, one which would make it possible for us to plot correct lines of equal rainfall, as we can now plot contour lines, can only be obtained after the observation stations and rain gauges have been established, and have been working for many years. We look forward, however, to the preparations of a complete hydrographical survey, and to a time when rainfall measurements and stream gaugings will be carried out systematically all over the country as a matter of course.

At the Fourth Annual Meeting of the Municipal Waterworks Association held in London on Friday last, this matter was discussed by Mr. E. Antony Lees, secretary and manager of the Birmingham Corporation Water Department, in a "Memorandum on the Computation of Rainfall on Gathering Grounds." Mr. Lees dealt chiefly with the Welsh gathering grounds for the supply of Birmingham, giving results of the rainfall gaugings on that area and drawing attention to the differences in the computation obtained by averaging the rain gauge readings and in the computation obtained by determining areas of equal rainfall, which areas were ascertained by plotting the lines of equal rainfall on a map. The provision of twenty-five rain gauges, and the careful records of the last seven years, have provided information which is of great value in deciding reservoir capacity, but so short a period of observation does not justify general conclusions. It is generally admitted that in order to obtain a

correct average a much longer period is required. It is generally believed that a period of about thirty-six years represents the rainfall cycle. Observations of the rainfall on the Birmingham gathering grounds will be chiefly useful in the future. In the case of Birmingham only a portion of the ultimate scheme of reservoirs has yet been constructed, and the extension of the scheme must depend largely on the rainfall gaugings, and on these will largely depend the hastening or delaying of such work.

It is generally agreed that the collection and careful collation of hydrographical statistics for the whole country is a matter of great material importance; but, as Mr. Lees very justly says, though the establishment of rain gauges and the keeping of records are carried out by many water authorities, these have often been discontinued on completion of the works on the ground that they were no longer of practical service. But if water supply is regarded as a matter of national importance, it is evident that such observations ought to be continued, because the rain gauges of one district furnish valuable data in laying down the lines of equal rainfall beyond the district in question. The author has done good service in bringing this matter forward, especially at the present time, when an advance is certainly being made in the direction of obtaining the information which will be required by the new central authority when it is established. The recent report on the water undertakings in this country, published by the Local Government Board, the excellent work of the Geological Survey, the rainfall reports of Dr. H. R. Mill, the annual reports of the Metropolitan Water Board, and the records of other water authorities such as those described by Mr. Lees in his paper, go far to give us the information required and to show the best way in which the work may be done when the water supply of this country is considered as a whole. This is not a time when much attention can be given to domestic legislation, but much useful work may be done while we are waiting, and that it is being accomplished, and that its need is fully grasped may be gathered from the efforts which are now being made, and we would urge all those who have it in their power to do so, not only to take observations, but to publish the results.

* * *

Expert Knowledge and Popular Criticism.

Apropos of a scheme for the disposal of sewage from a New York State hospital, the *Municipal Journal* of New York has an article on "Expert Knowledge *versus* Popular Ideas," which is worthy of attention. The proposal of the State authorities is to treat the sewage in the most thorough manner, and apply chlorine disinfection before the effluent reaches the intake of the water supply system, which it will do after weeks or months of delay. Regarding this process as quite trustworthy, our contemporary expresses astonishment that a New York newspaper should "hysterically demand that the sewage should be entirely removed from the water shed at a cost of £80,000, and £5,000 a year for pumping costs, in spite of the approval of the purification scheme by the State Board of Health, the city health commissioner, and Professors George C. Whipple, C. E. A. Winslow, H. N. Ogden, and others of high standing as sanitarians." The moral which the writer in the *Municipal Journal* draws from this Press campaign is that, "in spite of crowding of cities, of less education of the lower classes, of greater poverty, and of the existence of structures and cities built before there was any sanitary science, the death-rate in most cities in Europe is lower than in any cities in this country; and we believe," he proceeds to say, "the reason to be that here there is less respect for authority, either of government or of knowledge, than in Germany, England, and France, and other European countries. We are suffering in our health, in our politics, and in other directions from this assertion of the 'free American's' right to think and act as he pleases on subjects concerning which he is comparatively ignorant. This undoubtedly results in a people with greater initiative and a wider range of knowledge; but it sometimes suggests that these are dearly bought in the acquiring."

We confess some of the reasoning in this quotation seems to imply a *non sequitur*. We should very much doubt whether we have less immunity in this country than they have in America from uninformed criticism, or from the intrusion upon the same of the active and intelligent newspaper man with a "scoop" as his objective. Quite recently, for instance, we have had a vehement outburst all over the country from people who have only a limited knowledge of what they are talking about against the continuance of municipal works, however necessary these may be for the public health and comfort, on the ground that they "cost money." Opposition to and criticism of municipal administration, common as it is to most communities, arises not so much, it seems to us, from any particular objection to the professional man or expert as to the incorrigible niggardliness of the ratepayer who, as he terms it, feels the pinch, and to an ingrained disposition to grumble without any particular cause. This last disposition is a privilege which the Briton clings to and asserts upon every available occasion.

* * *

"Domestic Purposes."

The principle by which water undertakers are as a general rule compelled to afford a supply of water at statutory charges for "domestic purposes" has led to much legal discussion as to the precise meaning to be attached to this phrase. Only last year the House of Lords had the matter under consideration in the well-known case of *The Metropolitan Water Board* v. *Avery*, in which the dispute was as to the legal character of water supplied to the licensee of a public-house where luncheons were served and used for cooking the food and washing up the plates and dishes. It was held that this water was used for "domestic purposes," and the dictum of one of the judges of the Court of Appeal to the effect that the test is not whether the water is consumed or used in the course of trade, but whether the user of the water is in its nature domestic, was approved. The principle involved in this decision was so important as to lead the clerk to the Metropolitan Water Board, Mr. A. B. Pilling, to collect and collate information on the subject and to embody the results of his inquiries in a very interesting paper and digest.

To those who are not acquainted with the history of water legislation, the negative form in which the ordinary legislative definition of "domestic purposes" is cast will probably occasion some surprise. As far as the Metropolis is concerned, the reason for this is to be found in the fact that in the earlier Acts obtained by the companies no definite rates were stipulated, the charges in every case being left to agreement between the undertakers and the consumer. In practice, however, the companies found it convenient to prescribe scales of charges for domestic supply, but in addition a large number of supplemental charges were made for high service, water closets, baths, animals, carriages, and many other matters. The reason why these supplies were excluded from the term "domestic purposes" was the desire of the companies to protect themselves against undue consumption, and in this practice may be found the origin of the negative or excluding form which statutory definitions of the phrase have since assumed. Although the

case, if the detrition has in many instances been preserved, the information collected by Mr Pilling shows that there is a remarkable diversity in the various special Acts as to the nature of the powers excluded, and a general consensus of opinion is expressed in the covering replies suggesting that some attempt should be made to secure uniformity. There was general agreement with this suggestion at the annual meeting of the Municipal Waterworks Association last Friday, at which Mr. Pilling's paper was read, and it is therefore to be hoped that some combined action may be taken by water companies and authorities with a view to obtaining from Parliament a short general Act clearly setting forth what a supply for "domestic purposes" does and does not include.

* * *

Law and Engineering.

On another page in this issue will be found a paper entitled "Law and Engineering: Some Points of Contact," which was read before the Society of Engineers last Monday by Mr. Sydney G. Turner, ASSOC.M.INST.C.E., Barrister-at-law. The paper deals with a wide variety of topics, which, as the author said in his reply on the discussion, had been chosen more or less arbitrarily as illustrations of his main theme—viz., the advocacy of the establishment of some periodical meeting at which lawyers and engineers could discuss together the many subjects which are of mutual interest. The examples of suitable subjects for discussion selected by the author were certainly of a very diverse character, but our readers will probably agree with him that there is perhaps no branch of engineering practice which is so closely bound up with the law as that of municipal engineering, for the very nature of the business of the municipal engineer involves the administration of a large number of complex Acts of Parliament, and he must be possessed of a sound knowledge of the general principles of the law and practice of local government. The subjects suggested in the paper—sewerage and drainage, highways, and private street improvement works—by no means exhaust the matters of common interest to the legal and municipal engineering professions, and if such a meeting as Mr. Turner advocates were established, there can be little doubt that it would be widely supported by municipal engineers. Mr. Percy Griffith, who, in the unavoidable absence of the president, occupied the chair, stated at the outset that the council of the Society of Engineers had already considered the proposal contained in the paper, and that they were in full agreement as to its utility. We can only add, in judicial language, that "we are of the same opinion," and cordially hope that a small representative committee may be formed with all convenient speed to evolve some practical proposal.

* * *

The Municipal Waterworks Association.

Established only four years ago, the Municipal Waterworks Association has already proved its utility and thoroughly justified its existence. The recently issued Government return as to water undertakings in England and Wales in normal times might have been expected to be a prelude to legislation embodying a scheme for mapping out the country into watershed areas on the lines of the recommendations made by several Royal Commissions and Select Committees in the past. It is to be feared, however, that all such legislation must be postponed for some time to come, and there would therefore appear to be all the more reason why the association should continue and enlarge its activities. Hitherto membership has been restricted to representatives of municipal corporations or water boards in the United Kingdom supplying water to populations of over 50,000, but at the annual meeting of the association, held on Friday last, it was decided that representatives of authorities supplying populations of over 20,000 should in future be eligible for election. The association has probably acted wisely in thus throwing open its doors to the smaller authorities, for, as Lieut.-Colonel Porter, the new president, pointed out, the number of subjects in regard to which the smaller and larger authorities are in accord is much greater, and the subjects themselves are more important than those where there may not be complete sympathy. It is to be hoped, therefore, that, with its wider membership, the usefulness of the association in the coming years may be even greater than it has been in the past.

* * *

Bognor.

Mr. Bridges has not over stated the case when he claims for Bognor that it is now one of the best-known towns on the South Coast, and that during the past twenty years it has leaped into popularity as a first class seaside resort. Quite what "first class" means may be left undefined; we should ourselves have sought safety in the description "middle class." We can speak from personal experience, as we have known the delightful resort for at least as long as Mr. Bridges has known it officially—a fairly-long span of a man's life. And we unhesitatingly support the claims he makes for its unsurpassed sands, its breezy temperature, its perfect sweetness and cleanliness, and its homely amenities. Mr. Bridges has left upon it an indelible record of his forethought, his never-resting enterprise, and his engineering skill; and if he had been still more unfettered in his ambitions he would have made it an even more attractive town. Notably is this the case with the pier buildings, which as built are ill-balanced and blot out the fine view there would have been along the imposing esplanade if Mr. Bridges' strikingly more suitable design had been carried out. Some day, perhaps, the obtrusive arcade of very indifferent shops, which appear to be as little a success commercially as they are architecturally, may be scrapped, though it is to be feared that the town council have parted with the ratepayers' birthrights for that stupendously egregious half-guinea. Was there ever such another deal in municipal history?

* * *

Education and Status.

In delivering his presidential address at a recent meeting of the South African Institution of Engineers, Mr. W. Ingham, M.INST.C.E., the chief engineer to the Rand Water Board, dealt principally with the questions of engineering education and the status of the engineer. In alluding to the former subject he pointed out that although many of the great engineers of the past were men of comparatively little education, when judged by modern standards, the young aspirant to success in the engineering profession cannot work on the same lines to-day. A sound technical education is of great and ever-increasing importance, and Mr. Ingham was giving good advice in telling the young engineer, not only to get a sound technical education before entering the profession, but also to seek experience rather than money in his early years. The problem of improving the status of the engineering profession, to which Mr. Ingham also referred, is, in our opinion, closely connected with that of education. Once it is realised that entrance into the engineering profession demands a good liberal and technical education, no small step will have been made towards a more generous public recognition of the engineer's work, and to the securing of some practical improvement in regard to security of tenure, the certainty of reasonable remuneration, and other matters which at present form the subjects of substantial and legitimate grievances.

The Computation of Rainfall on Gathering Grounds.*

By E. ANTONY LEES, Secretary and Manager of the Birmingham Corporation Water Department.

The basis of any method of computation is the rain-gauge, and this it is quite unnecessary to describe, premising only that it is of approved pattern and of sufficient capacity. It must, however, be remarked that the rain-gauge furnishes a record simply of the rain which finds its way into the gauge glass, and that such record is not of necessity and by itself a record of the actual rainfall of any particular area, and in order to constitute the rain-gauge a record of the actual precipitation, even in its immediate vicinity, it is necessary that it shall be located and fixed with the utmost care in view of the surrounding conditions.

Assuming the rain-gauge to be so constructed and placed that it shall correctly record the precipitation in its immediate vicinity, the next question which arises is—to what area can the rainfall so ascertained be properly applied? And it will be apparent that the fact that a number of gauges distributed over a tract of country yield varying results involves the limitation of the area to which each record applies.

A common way of computing the total precipitation over an area is by establishing a number of rain-gauges within the area and making an arithmetical mean of their records, applying that figure to the total area.

Assume, for instance, an area of 10,000 acres on which four rain-gauges are established, giving records of 25, 27, 29 and 31 in. per annum respectively. The arithmetical average of the four gauges is 28 in., and applying the factor of 22,600 gallons per inch of rain per acre, we have a total rainfall for the area of 6,328 million gallons. It is evident, however, that this method assumes that the record of each of the several gauges applies to an equal area. In practice this will not be the case, and it might easily be that the reading of the 25-in. gauge applied to half the area, the 27-in. to one-quarter, and the 29-in. and 31-in. records to one-eighth each. Under these conditions the total precipitation on the area would be 6,045 million gallons, an appreciable reduction. Conversely, if one assumed a larger proportion of area for the higher readings, the computation for the whole area would be correspondingly greater.

In practice the location of the rain-gauges would be selected according to the conformation of the country, so as to secure such a proportion of higher or lower records as to bring the arithmetical mean roughly into accord with the physical facts. It is clear, however, that the only method by which an arithmetical average can be made to approximate reasonably to the actual rainfall for the whole area would be the provision of so large a number of gauges that the effect of the differences in area to which their readings applied should be eliminated. The objection to this would be the cost of providing and maintaining the gauges and of obtaining the readings.

Another and more scientific method is to use the readings of rain-gauges, not as direct indications of precipitation, but as elements in a calculation whereby areas of equal rainfall may be determined. This is achieved by the plotting of isohyetal lines on a map of the area. It may be explained that by an isohyetal line is meant a line passing through points having the same rainfall for the period under review, say a year. Such lines are determined by means of all the available data, using for the purpose the readings not only of the rain-gauges established in the specific area under consideration, but also those over a large tract of surrounding country. By the utilisation of these data, and comparing the reading of one gauge with another, lines along which the precipitation is uniform can be determined, and provided that the isohyetal lines are sufficiently close to each other, it is a safe inference to apply to the area enclosed by any two of them a mean value of precipitation, and so arrive at the total rainfall for the period with much greater accuracy than by the application of an arithmetical average of the gauge records.

It must, however, be noted that the drawing of isohyetal lines is not accomplished merely by the mechanical process of linking up on the map gauges showing similar records, but is a process requiring great judgment, mature experience, and attention to the natural configuration of the district. One of the advantages of the isohyetal method is that it attracts attention to anomalous readings, and enables errors to be detected.

Applying the foregoing general remarks to the case with which the writer is particularly familiar—namely, the Welsh gathering ground of the Birmingham water supply—the following notes may be of interest to members:—

The gathering ground is that of the Upper Elan and Claerwen Rivers in Radnorshire and Breconshire, and contains an area of 45,562 acres.

At the time of the preparation of the scheme by the late Mr. James Mansergh, F.R.S., the only available data were the records of a rain-gauge which had been established for twenty-one years, and which gave a mean fall of about 63 in. Four additional gauges were immediately established, and shortly afterwards three more, making a total of eight gauges up to the end of the year 1905. In 1908 three of these gauges were discontinued, in consequence of the submergence of their sites.

It may be remarked that the gathering ground has only been partially developed as regards the construction of reservoirs, and in order that the advisers of the department might have proper data for determining the time for constructing additional reservoirs and the capacity thereof, steps were taken in the year 1907 to provide improved means of obtaining accurate records of the gross and available rainfall. The advice was sought of Dr. H. R. Mill, the successor of Mr. G. J. Symons, founder of the British Rainfall Organisation.

Dr. Mill advised the provision of ten additional gauges, and located on the map the positions in which they should be placed. In 1910 he made a two days' expedition over the gathering ground, inspecting all of the gauges. Dr. Mill then advised the fixing of four additional ones, bringing the total up to nineteen. In 1913 six more gauges were added, making twenty-five in all, which is the number at present.

After his inspection Dr. Mill was instructed by the Water Committee to prepare a report on the rainfall of the gathering ground for the years 1908 and 1909, on the basis of the gauges then established. He worked out his conclusions by the isohyetal method, and his reports on those lines have since been continued annually.

The following table gives a comparison of the figures of rainfall since 1908, arrived at by the two methods, and also shows the differences in inches and in percentages between the isohyetal and the arithmetical method:—

Year.	Number of rain gauges	Average rainfall for the year over the entire watershed.		Excess of col. IV. over col. III.	Percentage of col V. to col. III.
		By arithmetical average of the rain gauges.	By isohyetal calculations.		
I.	II.	III.	IV.	V.	VI.
1908	15	59·3 in.	60·9 in.	1·6 in.	2·70 %
1909	15	62·6 ,,	63·4 ,,	·8 ,,	1·28 %
1910	19	77·7 ,,	82·3 ,,	4·6 ,,	5·92 %
1911	19	60·5 ,,	64·5 ,,	4·0 ,,	6·67 %
1912	19	73·5 ,,	78·3 ,,	4·8 ,,	6·53 %
1913	25	70·6 ,,	72·5 ,,	1·9 ,,	2·69 %
1914	25	74·3 ,,	76·4 ,,	2·1 ,,	2·83 %

It is interesting to observe that the widest discrepancy fell in the years 1910, 1911 and 1912, and that with the bringing into commission of the six additional gauges recommended in 1910, the discrepancy was much reduced. This in itself indicates the soundness of judgment displayed in the selection of the sites.

The term of years over which the observations have been carried out is not long enough to justify any general deductions. So far as they go, however, the indication is that isohyetal calculation in this case

* Paper read at the Annual meeting of the Municipal Water Works Association held in London on Friday last.

[illegible] practical average. Take [illegible] 2½ per cent. daily, over so large an area a very large quantity of water is represented, and, seeing that 30 per cent of the annual total rainfall may be looked for in the summer months (May to September inclusive), it may well be that the advising engineer would find himself justified in calculating on a considerable additional supply during the part of the year which, from a waterworks standpoint, is the most critical.

It must be recognised that by a different locating of rain-gauges the records might, on arithmetical average, have given a higher value than on the isohyetal method. In such a case the assumed rainfall would exceed the facts, and an error in this direction might easily entail serious consequences by leading to exaggerated anticipations of yield.

It may be asked what useful purpose can be served by these observations. The answer, in the case of Birmingham, is, as indicated above, that, as a portion only of the ultimate scheme of reservoirs has been constructed, the question of available rainfall will clearly be an important element, not only in finally deciding the capacity of future reservoirs, but also in determining the date on which they must be provided; for it is clear that, if more rain than had been assumed can safely be expected in the summer months, when there would be available capacity to store it (and if there were not, it would follow that the reservoirs were already full), the date for the construction of further reservoirs could be somewhat deferred. Similar considerations to these would apply in the case of all partially-developed gathering grounds. It is, however, taking too narrow a view of a question of this kind to confine it to considerations of immediate and local utility, and the writer is quite sure that all of the members of the Municipal Waterworks Association share with him the opinion that the collection and careful collation of hydrographic statistics for the whole country is of great national importance.

The establishment of rain-gauges, and the keeping of records, are carried out by most water undertakings. There have, however, been cases where rain-gauges have been discontinued on the completion of works on the ground that they were not longer of any practical service. Even if this be true as regards a particular undertaking, it is manifest from what has already been written that returns of rain-gauges in one district furnish valuable data for the laying down of isohyetal lines beyond such district, and as all water undertakings have benefited by information previously ascertained, collected and collated, some return for the benefit received should be made towards the common stock of knowledge on the subject. The object to be aimed at is to obtain a continuous record of rainfall observations covering the country, so as to enable isohyetal lines to be plotted for every district.

In the opinion of the writer it should be made a statutory obligation on all water undertakings and local authorities generally to establish and maintain properly-located rain and stream gauges, and to make them available for national purposes.

A Costly Indiscretion.—At Wednesday's meeting of Derby Town Council it was reported that, through an indiscretion on the part of the then youngest engineer in charge, who had now left their service, the new steam turbine at the power station had sustained damage which would cost £300 to repair.

Burnley Waterworks Difficulties.—At their meeting on Wednesday, Burnley Town Council decided to promote a Parliamentary Bill to acquire further borrowing powers in respect of the new reservoir at Hurstwood. It was mentioned that the work was originally let for £158,000, and it was anticipated that the scheme would be completed well within the Parliamentary estimate of £215,000, for which borrowing powers were obtained. The original contractors became bankrupt after the work had been three years in progress, by which time they had received £35,000 for work done. Fresh tenders were invited, but these were considered so high that the Water Committee decided to complete the undertaking themselves, under the charge of the engineer. Up to the end of last July the amount spent was £175,984, and the engineer, Mr. Diggle, estimated that it would require another £151,000 to finish the scheme. There had been an enormous rise in the price of labour and materials, and the site had disclosed many difficulties which were not anticipated.

THE STATUS OF THE ENGINEER.*

By W. Ingham, M.Inst.C.E., M.I.Mech.E.,
Chief Engineer to the Rural Water Board.

I am strongly of opinion that this matter deserves very careful consideration. I do not wish it to be understood that I am in favour of spoon-feeding the engineer, but I am of opinion that something should be done in regard to security of tenure, fees, and the relative position of the engineer and his employer in private practice.

Engineering constitutes the basis of industrial progress throughout the world, and no matter what branch of the industry is considered the engineer is the pioneer and prime mover. The inception, design, construction, and subsequent successful operation of any work has to be carried out by the engineer, and he is, always has been, and always will be an indispensable factor in the progress of civilisation.

It is very satisfactory to the real engineer—the man who has his profession at heart, the engineer who makes engineering his hobby and loves it for its own sake—to know that he is doing something which is really useful for the world's progress. The engineer has not as yet come into his own, but the day is fast approaching when he will receive far greater consideration than he has in the past. The heads of the profession have very little to grumble about, but in the case of the rank and file it is often otherwise.

Before closing my remarks I desire to offer a few words of advice to our young engineers:—

(1) Get a sound technical education before you enter the profession.

(2) Do not be in too big a hurry to obtain money at the commencement of your career; get experience instead.

(3) Don't be afraid of hard work.

(4) Visit works at every opportunity.

(5) Don't drop your work because it is after office hours.

(6) Let your principal aim in life be engineering, but don't overlook the fact that you must have a certain amount of recreation, so that you may have a sound mind in a sound body.

(7) Don't overstudy, or it will affect your originality and initiative.

The preliminary training of an engineer requires very careful consideration, and I think that a college education should go hand-in-hand with workshop training.

Brindley, George Stephenson and Fairbairn had only a parish school training, and Smeaton, Telford and Watt a grammar school education; but, although they were successful engineers, and have left a name behind them, we cannot work on the same lines to-day. I do not think that I am far wrong when I say that an engineer of thirty years of age, who has had a thorough engineering training, is in as good a position to investigate an engineering scheme as any of the engineers referred to above at the termination of their professional careers.

Municipal Economies at Liverpool.—Capital expenditure has for some time been discountenanced by the Liverpool Corporation, and although the work of some of the local municipal departments does not permit of much limitation beyond this, all have shown a readiness to make the attempt. Computations as to the amount saved to the ratepayers are not available, but the *Liverpool Post* says it runs to some hundreds of thousands of pounds.

Steam Roller Hire.—The surveyor to the Atherstone Rural District Council, Mr. H. J. Coleby, recently presented an estimate which he had prepared with regard to the upkeep of the roller so as to give the council some idea as to what charge to make to the Road Board for hire. The total cost, including repayment of loan, insurance, repairs, renewals, oil, and waste, worked out at 7s. 6d. per day, which was based on a full year's working. Driver's wages and other items came to 8s., making a total of 15s. 6d. per day. He suggested that the council should make a charge to the Road Board of £1 per day, which would cover all contingencies. The average daily cost to the council when they hired a steam roller was 19s. 7d. The council decided to make a charge of £1 per day.

* Extract from presidential address to the South African Institution of Engineers.

Law and Engineering—Some Points of Contact.*

By SYDNEY G. TURNER, Assoc.M.Inst.C.E., Barrister-at-Law.

The close connection which exists between the professions of law and medicine has long received visible recognition in the periodical meetings of the Medico-Legal Society, and the author has for some time past been of opinion that the no less close connection between law and engineering would amply justify the establishment of some similar periodical meeting at which lawyers and engineers could discuss the many subjects which are of mutual interest. A little reflection will serve to show how wide the range of such subjects is—so wide, indeed, that it is impossible to deal with them all in the present paper.

Writing in 1911, Lord Justice Fletcher Moulton (as he then was) said in the course of his introduction to Mr. L. W. J. Costello's volume on "The Law Relating to Engineering": "The profession of an engineer involves much more than mere engineering knowledge or even executive skill. In a large proportion of the matters in which he is consulted he has the responsibility of giving advice, and that advice often relates to acts in which the rights of third parties are directly or indirectly involved. This consideration alone would make it desirable that he should have a sound knowledge of such branches of the law as bear upon the questions he has to resolve. But his need of clear legal conceptions does not depend on this alone. He has not only to administer, but often to frame, contracts of a character which, beyond doubt, renders them the most complicated of any that have to be interpreted and pronounced upon by our Courts, and their nature is such that he can only pass on the responsibility to professional lawyers to a small extent. The rest deals with matters so technical that it must remain in his hands."

The general relation of law to engineering could hardly be stated more clearly; and if it is necessary for the engineer to possess some legal knowledge for the proper exercise of his profession, it is no less necessary—as may be seen from the result of a thousand cases—for the lawyer who is conducting a technical case to have at least such a bowing acquaintance with engineering as to enable him intelligently to cross-examine the expert witnesses on the other side. In the present paper the purpose of the author is to make as wide a survey as possible of the field of engineering practice, with a view to ascertaining some of the more important points of contact between law and engineering.

Expert Evidence.

Before carrying out this plan in detail, however, it will be convenient to consider some points of contact that are common to every branch of engineering. And first, as to expert evidence. If the examination and cross-examination of witnesses is an art, so also is the giving of expert evidence in a convincing and unshakeable manner.

It is not necessary to repeat here the old story of the classification of liars into three kinds—the superlative class being the expert witnesses—for, although it may have some merits as a jest, the idea upon which it is based is entirely false. Suffice it to say that, although the art of the expert witness can only be acquired by long experience, there are many questions as to the rules of evidence and the permissible limits of cross-examination that are of common interest to the lawyer and the engineer. As a general rule, the mere opinion of an individual is inadmissible as evidence of a material fact. To this rule, however, there has long been an exception in favour of the admissibility of the opinions of skilled witnesses whenever the subject is one upon which competency to form an opinion can only be acquired by a course of special study or experience. Observation shows that the experienced expert in giving his evidence in chief, speaks with authority and conviction, but is careful to avoid the appearance of mere advocacy. Before going into the box he endeavours to appreciate the case of the other side and to anticipate and consider possible lines of cross-examination, remembering that if he has expressed a different opinion at other times this may be put to him, and if denied be independently proved; and that he must be prepared to face a searching inquiry into the grounds or reasoning on which his opinion is based.

Engineer as Arbitrator.

The field of arbitration is another ground upon which the lawyer and engineer frequently meet. Either may be called upon to act as arbitrator, so that both must have a thorough knowledge of the powers and duties appertaining to the office. The position of the engineer as arbitrator is often one of peculiar delicacy and difficulty.

If, however, the contract so provides, as a general rule both employer and contractor must submit to his jurisdiction, for such a clause undoubtedly constitutes a "submission" within the meaning of the Arbitration Act, 1889, the first section of which provides that a submission, unless a contrary intention is expressed therein, shall be irrevocable, except by leave of the Court or a judge, and shall have the same effect in all respects as if it had been made an Order of Court. The independence of an engineer acting in a judicial capacity as arbitrator in a dispute between a contractor and his own employer is obviously open to question. Nevertheless, the appointment being the result of free contract between the parties, it is not open to the contractor to object to his acting merely upon the ground that he is open to suspicion of bias. On the other hand, of course, the arbitrator is bound to act with judicial impartiality and fairness. In the words of Lord Justice Bowen, in *Jackson* v. *Barry Railway Company*, 1893, 1 Ch., 238, in appointing the engineer as arbitrator, the parties "rely on his professional honour, his practice, and his intelligence, and the contractor certainly has a right to demand that, whatever views the engineer may have formed, he will be ready to listen to argument, and at the last moment to determine as fairly as he can, after all has been said and heard." In certain cases, however, the Courts have held that the contractor is entitled to be relieved from the arbitration clause. For example, if the engineer himself is a necessary witness at the inquiry, or if the question in dispute involves a consideration of the engineer's own conduct, it is manifestly unfair that he should act as arbitrator.

Contracts.

It will be remembered that, in the words of Lord Justice Fletcher Moulton, already quoted, he emphasised that the engineer has not only to administer, but often to frame, contracts of a character which, beyond doubt, renders them the most complicated of any that have to be interpreted and pronounced upon by the Courts, and their nature is such that he can only pass on the responsibility to professional lawyers to a small extent. It is not intended here to consider any of the matters which were so admirably dealt with in the lectures delivered by Mr. Costello in 1910-11. What he then said was quite sufficient to show that in the field of contract there is great community of interest between the lawyer and the engineer.

In view of the fact, however, that so much engineering work to-day is carried out by municipal and other corporations, it may not be amiss to recall that such bodies occupy a special position. For example, as a general rule a corporation, whether municipal or otherwise, can only contract under seal. To this general rule there are three exceptions—viz., (*a*) acts very frequently occurring; (*b*) acts too insignificant to be worth the trouble of affixing the common seal (*Church* v. *Imperial Gas Light Company*, 1838, 6 *A. and E.*, 846, *Mayor of Ludlow* v. *Charlton*, 1840, 6 *M. and W.*, 815); (c) where the purposes for which a corporation is created render it necessary that work should be done or goods supplied to carry those purposes into effect, and orders are given by the corporation in relation to those purposes, if the work done or goods supplied are accepted by the corporation, and the whole consideration for payment is executed (*Lawford* v. *The Billericay Rural District Council*, 1903, 1 K.B., 772).

In dealing with local authorities it must be remembered that, although a *rural* district council is in exactly the same position as a non-municipal corporation in regard to contracting under seal, the law as regards *urban* authorities is considerably modified by the provisions of sec. 174 of the Public Health Act.

* Paper read last Monday before the Society of Engineers.

1875. Sub-sec. (3) is of such importance as to merit some consideration. It provides that every contract made by an urban authority, whereof the value or amount exceeds £50, shall be in writing, and sealed with the common seal of such authority. The leading case on this sub-section is *Young* v. *Mayor, &c., of Leamington*, 1883, 8 A.C., 517, which was decided by the House of Lords. In that case the defendant council entered into a contract under seal with one Powis, for supplying their district with water. Powis failed to complete his contract, and it was put an end to. The council therefore by resolution authorised their engineer and surveyor to enter into a contract for completing the works. For this purpose the engineer and surveyor, as agent for the council, entered into a contract with the plaintiff which was not under seal. The plaintiff fully completed the works, which the council took possession of and accepted, and of which they continued to enjoy the benefit. It was held that the provisions of sec. 174 (1) of the Act of 1875 are obligatory, and not merely directory, and that as the contract was not under seal the plaintiff was not entitled to recover.

This case followed the earlier case of *Hunt* v. *Wimbledon Local Board*, 1878, 4 C.P.D., 48, in which a similar decision had been arrived at by the Court of Appeal, where plans had been prepared by the plaintiff, an architect, for new offices for the defendants. It would appear, however, that a subsequent ratification under seal of a contract which was not under seal is sufficient to comply with the requirements of the sub-section (*Lord Ashburton* v. *Torquay Corporation*, 1902, 1 K.B., 601). It has been held that contracts for a less amount than £50 need not be under seal nor in writing (*Hunt* v. *Wimbledon Local Board*, *supra*); nor does the sub-section apply to a contract the value or amount of which, in fact, exceeds £50 if the parties at the time of entering into it did not contemplate that it should exceed that sum (*Eaton* v. *Basker*, *&c.*, 1881, 7 Q.B.D., 529).

CERTIFICATES.

Before passing to a brief consideration of the points where law touches the practice of each of the principal branches of engineering, one other general matter must be mentioned—namely, the responsibility of the engineer in the giving of certificates. In ascertaining the amount due to a contractor, the engineer is acting in a quasi-judicial capacity, and in the absence of fraud an action will not lie against him for negligence in the performance of this duty. It has been held, however, that the ordinary clause providing for the giving of certificates during the progress of the work is not a submission to arbitration, nor is the certificate itself an award. Contracts are frequently drawn so as to make the giving of a certificate by the engineer a condition precedent to payment. In such cases the amount of the value of the work, although it becomes due on completion, cannot be recovered until a certificate has been given.

The question of the finality of a certificate when the contract contains an arbitration clause was discussed in *Robins* v. *Goddard*, 1905, 1 K.B., 294. In that case the contract provided for payment of the contractor under certificates issued by the architect, but it was further declared that "No certificate shall be considered conclusive evidence as to the sufficiency of any work or materials to which it relates, nor shall it relieve the contractor from his liability to make good all defects as provided by this contract." It was further provided that in case any dispute or difference should arise (with certain specified exceptions) it should be referred to arbitration, and the arbitrator should have power to open up, review, and revise (*inter alia*) any certificate. In an action by the contractor against the building owner to recover sums due on certificates issued by the architect, the defendant set up by way of defence and counter-claim that the work done and materials supplied were defective and unsuitable, and not in accordance with the terms of the contract. It was held by the Court of Appeal that the defendant was entitled to set up this defence and counter-claim on the ground that the arbitration clause destroyed the finality of the certificates.

MUNICIPAL ENGINEERING.

Perhaps there is no branch of engineering practice which is so closely bound up with the law as that of municipal engineering. The municipal engineer is charged with the administration of a large number of complex Acts of Parliament, and he must be possessed of a sound knowledge of the general principles of the law and practice of local government. On this matter the author can speak from his own experience, and this must be his excuse for dealing with this branch of engineering first and at some length.

SEWERAGE AND DRAINAGE.

Consider, in the first place, the work of the municipal engineer in connection with the sewerage and drainage of his district. The preliminary question of what is the meaning of the terms "sewer" and "drain" (which it is not proposed to discuss at length in this paper) has demanded the attention of the House of Lords—and many have thought that even they have not solved the puzzle—yet municipal engineers are frequently called upon to decide specific cases in the ordinary course of their daily work. The case considered by the House of Lords, to which reference has just been made, was *Wood Green Urban District Council* v. *Joseph*, 1908, A.C., 419. In that case a pipe running across the back gardens of several houses took the drainage of those houses into a public sewer. The houses drained into that pipe in pairs, each pair draining into it by a system of pipes shaped like a Y. Three of these pairs belonged to one owner, and the others to different owners. The stems of the Y's receiving the drainage of two houses belonging to one owner were admitted to be sewers. The question was as to whether the pipe running across the back gardens was a "single private drain."

Two points arose for discussion—first, as to whether the houses were "*connected* with a public sewer" by the pipe in question, as required by sec. 19 of the Public Health Acts Amendment Act, 1890, inasmuch as their drainage passed through an admitted public sewer (the stem of the Y) before entering the pipe in question; and, secondly, as to whether the pipe in question was a "single private drain." On the first point a majority of the House were of opinion that the intervention of an admitted sewer between the alleged single private drain and the houses served by it does not prevent those houses from being "connected with a public sewer" by such drain within the meaning of sec. 19. In other words, there can be a "single private drain" between two public sewers.

With regard to the second point, the judgment of the House is very difficult to understand, and is based on considerations which have not been dealt with in any of the earlier cases. The pipe in question was held to be a "sewer" and not a "single private drain," on the ground that sec. 19 applies only to conduits which (in the words of Lord Atkinson) "secs. 23 and 25 (of the Act of 1875) required the owners to provide or see were provided." Now, sec. 23 empowers a local authority to require the owner or occupier of a house which is not sufficiently or effectually drained to make a covered drain emptying into a sewer, or, if there is not a sewer within 100 ft., into a cesspool; and sec. 25 requires a similar drain to be provided in the case of newly built houses, or houses which are rebuilt. It would therefore appear to follow, as a necessary result of this decision, that the local authority must show that a pipe was a conduit, which secs. 23 and 25 of the Act of 1875 required the owners to provide or see was provided, in order to establish that it is a "single private drain," even if it takes the drainage of houses belonging to different owners.

With regard to the power to carry a sewer into, through, or under any lands whatsoever within the district of a local authority, conferred by sec. 16 of the Public Health Act, 1875, it should be noticed that this can only be done "if, on the report of the surveyor, it appears necessary." These words received careful consideration in the case of *Lewis* v. *Weston-super-Mare Local Board*, 1888, 40 Ch.D., 55. It was there held that "the surveyor" referred to in sec. 16 means a person duly appointed to be surveyor to the authority under sec. 189 of the Act, and, further, that the word "necessary" must be construed as meaning "necessary for the efficient discharge of the duty imposed by sec. 15 in the way most for the benefit of the public"; also, the person to determine the necessity is the surveyor, and if he exercises his judgment and comes to a conclusion in good faith, the Court will not interfere, even although other courses are shown to be practicable by which the entry on private lands may be avoided. The section further requires that reasonable notice in writing shall be given to the owner or occupier before proceeding to carry a sewer into, through, or under private land. Where a sewer is laid pursuant to the powers given by this section, compensation in respect of the damage caused must be paid by the local authority under sec. 308 of the Act. A local authority are not

empowered by the section to execute works which will be a nuisance, and will be restrained by injunction from doing so (*Lamacraft* v. *St. Thomas Rural Sanitary Authority*, 1880, 42 L.T., 365).

HIGHWAYS.

Another branch of municipal engineering work where the domains of the engineer and lawyer overlap is that relating to highways, and here it may be noted that the changing traffic conditions of recent years have not only produced many engineering problems, but have also resulted in the raising of a number of novel legal points. Before mentioning some of the actual cases that have arisen, however, it may not be amiss to say a few words as to the general law relating to the liability to repair highways.

It does not follow that, because a road is dedicated to the public and becomes a highway, the highway authority are liable for its repair and maintenance. Prior to the passing of the Highway Act, 1835, no distinct act of adoption was necessary in order to make a parish liable to repair a public road; if the road was public, the parish was, at common law, *primâ facie* bound to repair it (*Rex* v. *Inhabitants of Leake*, 1833, 5 B. and Ad., 469). Since 1835, however, some formal act of adoption has been required before a highway authority becomes liable for the repair of a new highway. This formal adoption may now take place in either of three ways—viz., (*a*) the formalities prescribed by sec. 23 of the Highway Act, 1835, may be observed; (*b*) a highway may be adopted by notice declaring it to be a highway repairable by the inhabitants at large, under sec. 152 of the Public Health Act, 1875, or sec. 41 of the Public Health Acts Amendment Act, 1890 (in districts in which that section is in force); (*c*) a highway may be adopted by notice, under sec. 19 of the Private Street Works Act, 1892, in districts in which that Act is in force. In the case of a highway dedicated since 1835, there is no liability on the part of the highway authority to repair unless one of these three courses of procedure has been followed (*Eyre* v. *New Forest Highway Board*, 1892, 56 J.P., 517).

Some cases may now be mentioned dealing with the liability of a local authority for damage caused by the manner of repair—*e.g.*, by the use of tar—which are of peculiar interest at the present time. The leading case is *West* v. *The Bristol Tramways Company*, 1908, 2 K.B., 14, where the plaintiff, a market gardener, successfully claimed damages for injury to plants and flowers caused by the fumes emanating from creosoted wood paving. The case was decided on the ground that the defendants had no statutory authority to use creosoted wood, but that their only statutory obligation was to pave, and a material which would not have caused damage might have been used. In these circumstances, having elected to use creosoted wood, they did so at their peril, and consequently were held liable for the damage caused.

The principle of this case has since been applied in a case against the Kent County Council (decided in the county court), where a cow was killed through drinking water which had been polluted by tar washed from road surfaces. In this case, as in the Bristol case, it was held that the treatment of the road with tar was not the only method available, and was not therefore absolutely necessary. Before leaving this part of the subject, two other cases are worthy of attention. The first of these was tried in the Swansea County Court, and damages were recovered against the Glamorganshire County Council, who had omitted to warn the public of extensive tar-spreading operations which were in progress. In the other cases, which arose in Ireland, a cyclist recovered damages against an urban district council for injuries received owing to the slipperiness of a highway which had not been sanded after tarring. In this case, however, the jury found negligence against the council.

PRIVATE STREET IMPROVEMENT WORKS.

Another branch of municipal engineering practice which is full of pitfalls for the unwary is that concerned with the execution of works of private street improvement. The comparative advantages of working under sec. 150 of the Public Health Act, 1875, and the alternative code provided by the Private Street Works Act, 1892, in itself provides plenty of scope for discussion. But in selecting a topic for discussion in the limited space now at the author's disposal, none appears to be more fruitful than the preparation of the apportionment.

The question sometimes arises as to whether, in case of error in or invalidity of an apportionment, the surveyor has jurisdiction to make a second apportionment. The general rule to be evolved from the cases is that when the first apportionment is for any reason a nullity—as, for example, in *Elsdon* v. *Hampstead Borough Council*, 1905, 2 Ch., 633, where an owner was erroneously omitted—the surveyor is not *functus officio*, and a second apportionment can be made. Under sec. 150 of the Public Health Act, 1875, if there is any dispute as to the proportion of expenses to be borne in respect of any premises, the matter is to be determined by arbitration. The apportionment, however, is binding and conclusive on an owner, unless within three months from the service of the notice on him by the local authority or their surveyor, of the amount settled by the surveyor to be due from such owner, he shall, by written notice, dispute the same (sec. 257 of the Act of 1875). The jurisdiction of the arbitrator is confined to the ascertainment of the proportion of expenses to be paid by a defaulting owner. He cannot inquire into the necessity for the works or the reasonableness of the expenses (*Bayley* v. *Wilkinson*, 1864, 33 L.J.M.C., 161).

GAS ENGINEERING.

Turning now from municipal engineering to other branches of engineering practice, it will be seen that the lawyer and the engineer have still much in common. For example, Parliamentary authority for the supply of gas must be obtained either by special Act or by a Provisional Order, which is afterwards confirmed by a public Act. Whichever course may be adopted, and whether the supply is to be by a company or by a local authority, the engineer must be familiar with the procedure and practice of the committee room. "Parliamentary authority having been obtained" (the author is now quoting from the Introduction to Michael and Will's well-known work on "The Law Relating to Gas and Water"), "certain consequences follow; the company obtain power to construct their works, and if need be to take land compulsorily; they have certain limits assigned to them; they obtain power to break up the public streets for laying and repairing mains and pipes. They obtain power to charge a maximum or standard price, and are given summary remedies for recovering that price by cutting off the supply, by warrant of distress, as well as by action in any court of competent jurisdiction. On the other hand, the company come under many obligations and restrictions; they are restricted to definite lands for the manufacture and storage of gas; they may be compelled by consumers to afford them a supply of gas; and such gas must be of the prescribed illuminating power, pressure and purity."

Here is a wide field for discussion, and a glance at the field of water engineering shows that there an even greater community of interest exists between law and engineering practice.

WATER ENGINEERING.

Take, for example, the difficult questions that arise in connection with subterranean water. The leading case on this subject is *Chasemore* v. *Richards*, 1859, 7 H.L.C., 349, in which the appellant, a mill-owner upon the river Wandle, had for upwards of sixty years enjoyed the use of the water in the river for the purpose of working his mill. The river was, and always had been, fed and supplied above the mill of the appellant by (among other sources of supply) the rainfall upon a district of many thousand acres in extent, which, either by streams or by percolating through the strata, found its way into the river. The local board of health for the town of Croydon dug a well upon their own ground, within the above district, and, by constantly pumping, abstracted large quantities of water, which would otherwise have found its way underground to, and have been applicable and serviceable to, the mill of the appellant. The natural effect of such constant pumping would be the sensible diminution of the water supply of springs and streams in the vicinity. The question was whether the appellant could maintain an action for the interception of the underground water, and it was held that such an action was not maintainable. It must be remembered, however, that such water as an owner does in fact receive through underground undefined channels, he is entitled to receive in its natural state of purity; so that it has been held that the owner of a well is entitled to an injunction to restrain its pollution by his neighbour's cesspool (*Womersley* v. *Church*, 17 L.T.N.S., 190).

ELECTRICAL ENGINEERING.

The necessary limits upon the length of a paper of this character render it impossible to do more

[illegible] some of the more important topics, each of which might form the basis of future discussion. Similar examples may be found in connection with electrical engineering. Thus, in connection with electric lighting undertakings—as in the case of gas and waterworks—questions of procedure and also points relating to the breaking up of streets arise; while in connection with tramways and light railways further questions at once suggest themselves.

As an illustration, the recent case of *The Charing Cross, West End and City Electricity Supply Company* v. *The London Hydraulic Power Company*, 1913, 3 K.B., 442, may be referred to. This was an action brought by the plaintiffs to recover damages for injury to their cables in four different streets, caused in each case by the bursting of the defendants' mains. The bursting of the mains was not due to any negligence on the part of the defendants, and the question for decision was whether they were under any liability as for nuisance. Two of the mains were laid under a private Act, which was silent as to liability for nuisance, but the other two had been laid under a later Act, which contained a clause to the effect that nothing in the Act should exempt the company from liability for nuisance. The later Act further provided that the two Acts should be "read and construed together as one Act." It was held that the defendants were liable as for nuisance in the case of the two mains laid under the later Act; and, further, that the effect of the two Acts being read together was to take away any privilege of the defendants under the earlier Act, and that consequently they were also liable as for nuisance in the case of the two mains laid under that Act.

CONCLUSION.

Although it is feared that this paper is open to the criticism that it is of so discursive a nature as to be of little practical value, the author ventures to hope that at least he has succeeded in the endeavour to indicate the number and variety of the subjects in regard to which the lawyer and the engineer may meet on common ground; and, further, that in the course of the discussion, opinions may be offered as to the desirability or otherwise of establishing some periodical meeting, open to the members of both professions, at which such subjects could be discussed.

DISCUSSION OF MR. TURNER'S PAPER.

In the absence of the president, Mr. Norman Scorgie, M.INST.C.E., borough engineer of Hackney, Mr. Percy Griffith, M.INST.C.E., F.G.S., past-president, occupied the chair on Monday at the meeting of the Society of Engineers at which the foregoing paper was read.

In proposing a vote of thanks to Mr. Turner, Mr. Griffith said it might be of interest to those present to know that the suggestions put forward in the concluding paragraph of the paper had been considered by the council of the society, and that they were in full agreement as to the utility of the proposals.

Dr. Wm. Garnett said he felt that a man in any one profession had an enormous advantage if he had an acquaintance with the work of some other profession. That was especially true of the lawyer, and more particularly of the barrister. On the other hand, Mr. Turner had given them many examples of the necessity for an engineer having something more than a bowing acquaintance with the law, and especially with the law appertaining to his duties.

Mr. J. W. Gordon, K.C., thought that, from the lawyer's point of view, periodical meetings between the members of his profession and engineers would be of very great advantage. No one could afford to be completely ignorant of the law. The study of the law, even in the most liberal sense of the word, had come to be looked upon as the exclusive duty of the profession dedicated to the service of the law; but the wider view was, he ventured to think, the sounder one. It was impossible for an engineer to be efficient without some knowledge of the law.

Mr. Graham Mould remarked that, as a rule, of course, it was better for a man to stick to his own trade, but there were so many points where law and engineering came into contact that every surveyor and engineer must of necessity be in part a lawyer.

Mr. E. Willis, engineer and surveyor to the Chiswick Urban District Council, in commenting on the proposals put forward by the author of the paper, observed that the municipal engineer must be acquainted with the law, or he was practically certain to get his council into trouble, and he was quite of opinion that they should at any rate take an elemental course in law, and especially public health law. Such a course was a part of the syllabus of the Surveyors' Institution examination. In considering the question of the engineer as arbitrator, we all made mistakes, but he thought that, on the whole, they must look upon the engineer as a man of absolute integrity, who, in his position as arbitrator, could be trusted to give just decisions. The difficulty of the quasi-arbitrator was, he agreed, one with which contractors had at times to contend, but he certainly thought that when acting in that capacity he should be held liable for negligence in the performance of his duty, and guard against ignorance in the issue of certificates. The clause in the Act referring to contracts for small amounts was undoubtedly one through which the proverbial coach-and-four could be driven. There were many instances of goods of over £100 in value having been obtained without contracts being made, as required, for in practice all that was necessary was to order the goods in instalments, the provision of the Act thus being complied with. The case of *Young* v. *Mayor, &c., of Leamington* had been cited in connection with the question of contracts under seal, but he thought every lawyer present would admit it was not equity that the contractor in that particular case should not have been paid. The importance of the Private Street Works Act, observed Mr. Willis, in conclusion, should be emphasised, for while it undoubtedly had many disadvantages, it had the great advantage that after a work had been carried out no question of any kind could be raised.

Mr. H. T. Chapman, county surveyor of Kent, said it was a very moot point as to how far engineers should go in the practice of their legal knowledge. Although it was most desirable that they should have some legal knowledge affecting their work, he doubted whether it would help them very much. There were many legal points cropping up in connection with work they were bound to carry out, and if they had to give their attention to these whenever they arose they would get very little work done. With regard to the Bristol case, there had been millions of yards of creosoted deal laid since, and he had not heard of a case of a similar kind. As to misfeasance and non-feasance, there were many repairs of highways which might lead them into pitfalls, but they were protected to some extent by the contributory negligence of the user of the highways. Mr. Turner had referred to the Kent case of the cow which was poisoned through drinking water alleged to have been polluted by tar washed from road surfaces, but he thought it had been proved by a post-mortem which was held that the animal in question had helped itself to the contents of a bucket of tar in a farmyard. (Laughter.) They had a similar experience last summer. They were tarring a road in East Kent, and a cow consumed a quantity of tar which had been left in a bucket on the side of the road. A claim followed, but the county council repudiated it, and the matter went no further. As to certificates, it was hardly fair to assume in all cases that the whole of the work for which an engineer gave the certificate was perfectly carried out. There were certain classes of engineering work which could not be tested until after completion—he was thinking of reinforced-concrete structures. If an engineer had to withhold a certificate until a work of that kind was in accordance with the tests specified he might have to wait a very long time before he got his money, and it meant in many cases that the greater portion of the work must be completed before any payment was made.

Mr. W. G. Kershaw (Hampstead) remarked that, of course, no one could practise in two professions successfully, but the advantage of a dual knowledge of law and engineering had been illustrated over and over again.

Mr. Turner, in replying, said the object he had in view was not that the engineer should try to be a lawyer, or *vice versâ*, but that each should fortify himself in his profession with some knowledge of the other, and if the council of the society thought fit to take up his suggestion he need hardly say that he would do all in his power to help them.

ROAD SWEEPING BY MOTOR BROOMS.

RESULTS OF SIX MONTHS' WORKING IN DEPTFORD.

The following report dealing with the first six months' working of a motor-sweeping broom was presented on Tuesday to the Deptford Borough Council by the borough surveyor, Mr. J. Sutcliffe, Assoc.M.Inst.C.E.:

Date of commencement, February 22, 1915.
Date of end of record, August 21, 1915.
Speedometer fixed, April 10, 1915.
Number of days worked, 138.

(The machine was out of order for four days, due to a defective casting, which was replaced by the makers under guarantee.)

Mileage recorded (actual and calculated), 4,029·12 miles, an average per day of 29·2 miles.

Length of roads swept, 590·14 miles, an average per day of 4·28 miles.

From this it may be seen that the machine has to travel 6·83 miles for every mile of road swept.

Petrol consumed, 532 gallons, an average of 3·86 gallons per day, and 7·57 miles per gallon.

Lubricating oil used, 136½ gallons; 1 gallon to 29·52 miles.

Axle grease used, 130 lb.; 1 lb. to 31 miles.

Number of broom refills worn out, 20, of which the first 8 were ordinary "C" quality, costing £1 8s. each, and the remaining 12 "Double life" quality, costing £2 8s. each.

Average life of "C" quality, 21 hours 25 minutes.
Average life of "Double life" quality, 48 hours 22 minutes.

COST.

Assuming the life of the machine to be eight years and depreciation therefore to be 12½ per cent per annum, the actual working costs are as follows:—

		£	s.	d.
Cost of machine, £628.				
Depreciation (for six months)	..	39	5	0
Wages paid to driver	... ...	66	2	11
Petrol—532 gallons, at 1s 4d	..	35	9	4
Lubricating oil—136½ gallons, at 2s. 1d		14	4	4
Axle grease—130 lb., at 4d	... ...	2	3	4
Broom refills	£ s. d.			
Eight at £1 8s. ..	11 4 0			
Twelve at £2 8s.	28 16 0			
		40	0	0
Total for six months		£197	4	11

This is equivalent to 6s. 8·15d. per mile of roadway swept.

For purposes of comparison I append the original estimate of the cost, which was submitted to the committee in December last, when the purchase of a broom was under consideration.

	£	s.	d.
Depreciation, 12½ per cent on £628 (for six months)	39	5	0
Repairs, 5 per cent on £628 (for six months)	15	14	0
Petrol, 482½ galls., at 1s. 9d	42	4	4
Lubricating oil, 48½ galls., at 2s. 6d. ..	6	1	3
Broom refills, 21 sets, at £2 8s.	59	8	0
Driver, 7 hours per day, 1,092 hours at 1od.	45	10	0
	£199	2	7

This was the estimated cost to sweep 612 miles, and is equivalent to 6s. 6½d. per mile of roadway swept.

HORSE BROOM SWEEPING.

You will remember that I submitted with the latter estimate a return as to the actual cost at that date of horse broom sweeping, which I repeat below:

Mileage swept per annum, 1,224; horse brooms in stock, 8; purchase price of each broom, £23; £23×8 = £184.

WORKING COSTS PER ANNUM.

	£	s.	d.
6 per cent depreciation on brooms...	11	0	0
Repairs to machine (8, at 15s.)	6	0	0
Refill brooms (80, at 24s. 6d.) ...	98	0	0
Seven horses and men, each 3 hours per day (6,552 hours, at 1s.)	327	12	0
	£442	12	0

Equivalent to 7s. 3d. per mile.

As, however, a great alteration has taken place in prices since the date when the foregoing cost was calculated, a true appreciation of the financial effect of the adoption of motor traction for sweeping is only accurately obtained by comparing the actual cost with what the actual horse traction has *been continued* over this identical period of six months, and below I give you these figures:—

Mileage per annum, 1,224 miles.

	£	s.	d.
6 per cent depreciation on brooms	11	0	0
Repairs (8, at 15s., plus 15 per cent) ...	6	18	0
Refill brooms (80, at 24s. 6d., plus 15 per cent)	112	14	0
Seven horses and men, each 3 hours per day (6,552 hours, at 1s. 3¼d.)	416	6	6
	£546	18	6

Equivalent to 8s. 11¼d. per mile.

It will be seen, therefore, that the work has actually been done for 6s. 8½ d. per mile, as against a cost of 8s. 11¼d. per mile, which would have been expended if the use of horse-drawn brooms had been continued. This represents a saving of 2s. 3d. per mile, which, multiplied by 590 (the six months' mileage) and doubled, gives us a saving on the sweeping of those roads of the borough that are swept by the motor broom of £132 15s. per annum.

I leave it to the committee's own judgment as to the comparative efficiency of the one system and the other, but I may say that the complaints with regard to mud splashing which used to be quite regular have entirely ceased. It is months since I heard any complaint with regard to dirtiness of the streets.

CORRESPONDENCE.

Εις ἀνὴρ οὐ πάντ' ὁρᾷ.
(*One man does not see everything.*)
—Euripides.

GLASGOW SCAVENGING.

To the Editor of The Surveyor.

Sir,—It is satisfactory to me to find that the questions under the weekly heading "Things One Would Like to Know" occasionally elicit answers, and I am much obliged to Mr. Greig, the superintendent of the Glasgow scavenging department, for his letter which appeared in your issue of the 1st inst.

Mr. Greig may be interested to know that I had looked at the other side of the account and observed that a revenue of £44,350 9s. 3d. had been obtained for the year in question, but in estimating the cost of any work for the purpose of finding out what the real cost has been it is better, in my view, to ignore any revenue that may be derived therefrom, as otherwise no check on cost can be made. It is, of course, very satisfactory to find that such a large revenue is obtained presumably by the sale of manure, house refuse, &c., unless "sanitation" is sacrificed thereby to revenue, of which, however, I have no information. Some of the "things one would like to know" in connection with the apparently high cost of scavenging in Glasgow would be, *inter alia*, what are the rates of wages and team labour, whether depot rents, &c., are included in the cost, what are the average lengths of cartage, what is the method for the ultimate disposal of the refuse, and any special local conditions as to steep hills, &c.

It would also be interesting to know what is the annual cost of street watering and hose washing which Mr. Greig informs us are included in the cost of scavenging.

If Mr. Greig could be induced, and could spare the time, to write a short article for your pages on the methods and costs of this work, I feel sure that it would be of the greatest value to all of us who are interested in the important subjects of scavenging, street cleansing, &c.—Yours, &c.,

Your Contributor.

Tree Planting in London Streets.—The suggestions that are made from time to time to vary the monotony of our street trees recall the fact that within the memory of many Londoners still living their streets were entirely bare of such adornments. Dr. Phené, the pioneer of this form of street improvement in the Metropolis, points out a writer in an evening journal, died only three years ago. In his "Memorials of Old Chelsea," Mr. Alfred Beaver states that "Dr. Phené built a considerable portion of Oakley-street. The trees there were planted by him, and Oakley-street thus enjoys the distinction of being the first London street planted with trees. Prince Albert examined them with interest in 1851, and the planting of the road in front of South Kensington Museum followed in 1852."

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

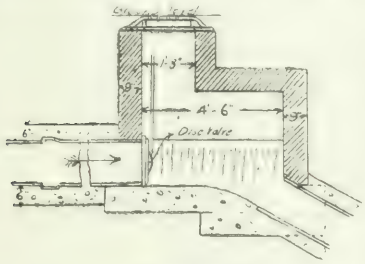
THE MONTHLY PREMIUM.

Mr. I. Hodgkiss of Walkden has chosen as his prize in the August competition "A Manual of Civil Engineering," by Prof. Rankine (Griffin), and "Water Works Distribution," by J. A. McPherson (Batsford). Both these books have been duly forwarded to him.

QUESTIONS.

This week answers are invited to the following questions:—

504. Bridge Design. A bridge is required to carry a 60-ft. street over a canal, the clear span being 40 ft., the minimum head room being 11 ft. at centre and 9 ft. at sides above normal water level. The ap-



MANHOLE B

proaches are to have gradients of 1 in 24 and 1 in 30 respectively. Sketch the bridge you recommend for such a position, giving all important particulars, short specification tests for materials, and tests for bridge when completed. (P. W., *Pontypridd.*)

505. Retaining Wall.—Design a retaining wall in concrete or concrete-steel to be loaded calculation. The height of proposed wall 35 ft., earth retained, dry gravel; foundation similar. (H. T.)

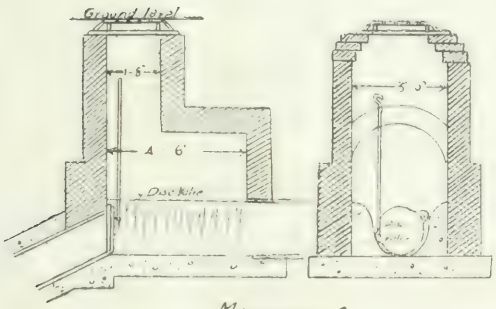
506. Concrete Sewer Construction.—Is it necessary to support concrete sewer tubes with concrete at the sides, the tubes being 21-in. diameter? If it depends on the depth below the street whether they should be supported by concrete or not, then what are the least and greatest depths at which they can be laid without concrete support at the sides? ("Polox.")

507. Design of Retaining Walls. What are some good, practical rules for the design of (1) brick and (2) concrete (not reinforced) retaining walls to withstand earth pressure? ("Polox.")

508. Street Construction.—Some new streets are to be laid out involving considerable cutting and filling of the ground. Longitudinal sections of the ground showing the levels of the new road have been prepared. The cutting and filling have to be measured up as the work proceeds. What is the best method of doing this? (Polox.)

REPLIES TO QUESTIONS.

503. Sewer Construction.—AB and CD are two 18-in. stoneware pipe sewers, intercepted at right angles by a railway in a cutting with slopes of 1 in 2. The fall of AB is 1 in 140 and CD 1 in 360. The invert level of B is 122·5; C=120·75; ground level 128·0, and level of railway metals 106·50 ft. above ordnance datum. Distance from B to C is 110 ft. Describe and show by sketches in detail how to connect the sewers AB and CD, showing provision for cleaning and inspection. The fall of both sewers is towards D. The railway company will not allow any sewer to pass underneath the railway unless at a greater depth from top of sewer to top of rails of 4 ft. (E. H., *Walkden.*)



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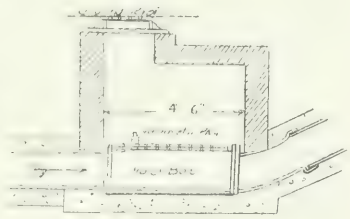

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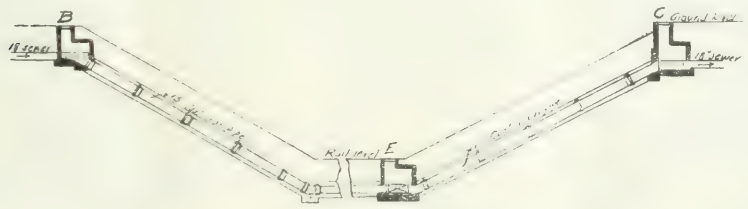

CROSS SECTION

The best method of connecting these sewers intercepted by the railway cutting is by means of an inverted syphon. There is a fall of 1 ft. 9 in. from B to C, and the length of the syphon is about 130 ft.; so a 15-in. diameter pipe with this fall flowing full would vent as much sewage as the 18-in. diameter outfall flowing full with a fall of 1 in 360. The diameter of the syphon pipe can thus be reduced to 15 in., which will mean a saving in the cost of

the pipes. The pipes should be cast iron and lead jointed, and encased in fine concrete 6 in. thick. The cross-section shown illustrates how the syphon is constructed, and details of the manholes are also given. In ordinary work the valves in the manholes B and C are open, and should it become necessary to clean out the syphon or effect repairs these valves should be closed. A diaphragm pump is then set up near the manhole C, with the end of its suction pipe dipping into the manhole E. The 3-in. gun-metal plug is then unscrewed from the lid of the hatch-box, allowing the sewage to enter the manhole E, and it is then pumped into the manhole C. The lid is next taken off the hatch-box, and the remainder of the sewage pumped into C. The trench for the syphon would be cut-and-cover, except where the pipes pass under the lines of rails, where a heading would be driven. (J. G. W., *Dunfermline.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Hayes U.D.C. (September 24th. Mr. R. H. Bicknell).—£400 for works of improvement in Yeading-lane and West End-lane.—The clerk, Mr. C. Dudley Lewis, who represented the council, stated that they asked for the loan for five years free of interest under the scheme proposed by the military authorities. The surveyor, Mr. D. C. Fidler, explained that the scheme was for resurfacing the roads and filling in the ditch on one side. The original estimate was £2,600, but the Road Board would not consider it, and cut the estimate down to the present figure. The length of the road was 2,065 yds.

Newport (Salop) U.D.C. (September 23rd. Mr. P. M. Crosthwaite).—£300 for the purchase of land adjoining the waterworks for the protection of the water supply of the urban district. There was no objection. The case for the council was presented by the clerk, Mr. J. T. Underhill. The land adjoins Baddeley's Wells, from which a portion of the public water supply of the district is drawn.

APPLICATIONS FOR LOANS.

Cardiff T.C.—£5,300 for the completion of the new fire station.

Darwen T.C.—£3,000 for electricity mains and services.

Ilford U.D.C.—£858 for electricity generating plant at the refuse destructor.

Todmorden T.C.—£200 for sewerage works.

LOANS SANCTIONED.

Barking U.D.C.—£13,654 in connection with the electricity undertaking.

Erith U.D.C.—£15,690 for electrical machinery (repayable within sixteen years) and £2,400 for building (repayable within thirty years).

Hendon U.D.C.—£1,240 for the purchase of a motor fire engine.

Manchester T.C.—£1,114 in connection with the Baguley sanatorium.

Middlesbrough T.C.—£1,356 for a road improvement scheme, and £9,000 for flood prevention and sewerage works.

Uxbridge R.D.C.—£562 for road improvements.

York T.C.—£1,251 for public walks and pleasure grounds, £965 for street works, and £5,312 for sewerage works.

FORTHCOMING INQUIRY.

OCTOBER.	£
12.—**Marlborough.** For the provision of suction gas pumping plant (Mr. W. O. E. Meade-King)	500

Huddersfield's New Hospital.—The formal opening has taken place of a war hospital built on corporation land at Royds Hall, at a cost of £22,500. The work was carried out under the direction of the borough engineer, Mr. K. F. Campbell.

INSTITUTE OF SANITARY ENGINEERS.

OPENING SESSIONAL MEETING.

The fact that a concert should, as in past years, form an important part of the programme of the opening sessional meeting of the Institute of Sanitary Engineers—which took place on Wednesday evening at Caxton Hall, Westminster—would seem not to have been without its effect on the attendance at that gathering.

"I think," said the president, Mr. A. P. I. Cotterell, M.Inst.C.E., in an address to the members, "we must all realise that to many of our members and to others any kind of entertainment, even to the limited amount that we have had to-night, may appear somewhat out of place at the present time. Last year we abandoned our annual dinner on account of the war, and if at that time circumstances justified this course, there is nothing to-day that can be said materially to alter the situation. This must account for the absence of a few of our friends, and we honour them for their views; but it is equally possible to carry a reasonable principle so far that it becomes a burden, and I think you will agree with me that, to the extent to which our meeting this evening has devoted itself to entertainment, there is nothing that need clash with our deepest feelings or with our sympathy with those who are suffering on account of the war. At the same time we cannot forget what is happening around us, and although human nature requires the lighter as well as the graver side, even at this time our thoughts go out to those whose lives are darkened by sorrow, or who are struggling with circumstances in a way that they would never have believed possible had it been told them two years ago."

THE INSTITUTE'S PROGRESS.

Proceeding to give a few particulars as to the standing and progress of the institute, Mr. Cotterell said: "It is a gratification to be able to say that the membership is not only maintained, but is still increasing. To-day we number no fewer than 518 members. Not only can we record an increase in numbers, but the qualifications of those who are admitted are also rising, and we are attaching to ourselves a class of men, especially from abroad, of whom the institute may well be proud. Our finances have also grown, and are improving year by year. We are paying our way, and are, I am glad to say, in a position of stability that enables us to look with confidence to our future as one of the permanent institutions of our profession.

"The programme of the forthcoming session is now before you. It is an interesting one in that we are to be almost entirely addressed by members of the chemical profession, some of them of considerable eminence. I do not know how it happened to come about that chemists and not engineers will be giving us papers, but perhaps it is just another symptom of the times. This is a day when civil engineering is practically at a standstill, and many of those who were formerly busily engaged in it are using their activities elsewhere. Hence it comes about that the voice of the chemist can be heard—he who is in some respects the pioneer of the engineer in that he is looking ahead, analysing and investigating steps which the engineer may afterwards turn into practical use.

A GLANCE INTO THE FUTURE.

"And what does the future hold? This truly is a question that many may ask, but none are capable of answering with satisfaction. We cannot but see that great changes will come as a result of the present world upheaval. We have been accustomed for so long to see sanitary improvements progressing little by little, social changes taking place, not only in our nation but in others, in which our own professional work has been bound up, that we naturally expect the old ways to be resumed when at last the dogs of war are leashed. But when the war is over is it likely that we shall return to the point at which we left off, or to the pace at which we previously ambled? So much world-wealth will have disappeared that many of the social improvements formerly in hand, or contemplated, may have to be set aside for years. On the other hand, such may be the condition of the people that wealth which under the circumstances would have poured into certain industrial channels will perforce have to be devoted to sanitary improvement and to the rebuilding of the health of the people. If such is

The Surveyor
And Municipal and County Engineer.

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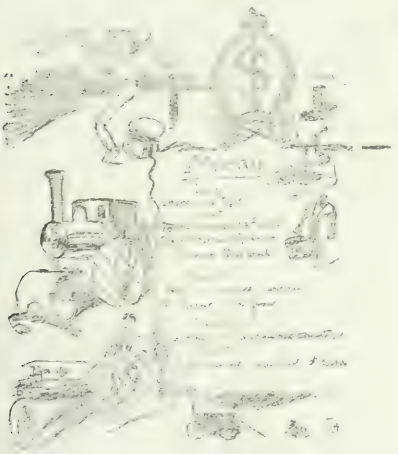
the case, and for my part I believe it will be, there is a real opening both for sanitary engineers than which what could be finer? It may be that they will be pioneers in a new campaign of social improvement, in the reconstruction of a race devastated and broken down by the effects of the war. It may be that we, in our small part, shall have our chance of rebuilding the world on a firmer basis, and with better prospect of continuance than we could have thought possible had it been told us in the days of peace."

MEXPHALTE ROAD WORKS IN MILITARY CAMPS.

Mr. C. Morland Hughes, who has been superintending the construction of 10,000 yds. of Mexphalte roads in Army camps, was recently the guest of the officers of the R.A.M.C. at Chiseldon Camp at a dinner arranged by them as a compliment to him for the work done at the hospital. At the function a



amusing menu was evolved, which is reproduced herewith, and in which many of the materials used in road construction are ingeniously worked into the items. The terms "DX" and "R. 1" refer to grades of Mexphalte. The menu card is profusely adorned with some very "free-hand" drawings.

Manchester Cleansing Department.—The annual report of the Manchester Cleansing Committee shows that the gross expenditure of the department for the year ended March 31st last was £221,265, and the income £152,362.

LOWER THAMES VALLEY DISTRICT SURVEYORS' ASSOCIATION.

ANNUAL MEETING.

The annual meeting of the Lower Thames Valley District Surveyors' Association was held at Twickenham Council Offices on Saturday last, a good number of members being present.

The following were unanimously elected as officers for the ensuing season:

President: Mr. R. H. Jeffes, engineer and surveyor to Maldon and Coombe Urban District Council.

Vice-president: Mr. J. G. Carey, engineer and surveyor to Heston and Isleworth Urban District Council.

Hon. Secretary and Treasurer: Mr. F. Sadler, engineer and surveyor to Acton Urban District Council.

Hon. Auditors: Messrs. F. W. Pearce, engineer and surveyor to Twickenham Urban District Council; and M. Hainsworth, engineer and surveyor to Teddington Urban District Council.

Votes of thanks were unanimously passed to the retiring officers for their labours on behalf of the association during the past year.

The hon. secretary presented the following report on the work of the past season:—

ANNUAL REPORT.

During the session seven meetings have been held; five of these were held at the Town Hall, Twickenham, and one each at Wimbledon and Surbiton. The whole of the meetings have been well attended.

The following papers have been read during the session: (1) "Supervision of Buildings under By-laws," by Mr. E. Willis; (2) "Road Inspection Signs," by Mr. C. H. Cooper.

Visits of inspection have been made to Surbiton and Wimbledon. At Surbiton the sewage disposal and refuse destructor works were inspected, and at Wimbledon the members had an opportunity of inspecting the S.O.S. system of dealing with sludge and the open-air bath in Wandle Park.

These visits, which were very enjoyable and interesting, were arranged by Mr. Mather and Mr. Cooper respectively, to whom our thanks are due.

During the session the important question of the advisability of extending the area of the association has been fully discussed, and while admitting with pleasure the honour which was done our association by surveyors outside the present area seeking admission, it was generally agreed that any large extension of the area, as was contemplated, was not in the best interests of the association.

The annual dinner was not held this year owing to the war. This is, I believe, the first time in the history of the association that this interesting function has been omitted, and I feel sure that every member regrets the fact that by this omission we were prevented from showing our appreciation of the excellent work our retiring president has done for the association, which a festive gathering of this kind affords.

In conclusion, I would mention that our best thanks are due to Mr. Pearce for the continued interest which he takes in the association, and for his good offices in connection with our meetings at Twickenham.

I beg to tender my own thanks to the president, vice-president and the members for the ever ready help which they have afforded me during my year of office.

(Signed) J. G. CAREY,
Hon. Sec. and Treasurer.

The auditor's report showed the finances of the association to be in a very satisfactory condition, the balance in hand being more than at the end of the last season.

The programme for the ensuing season was left in the hands of the president and secretary to arrange.

An interesting discussion took place regarding the arrangements made in the various districts to comply with the Orders and Regulations of the Home Office and the Commissioner of Police restricting public lighting. Another matter discussed was the increased charges to be made to gas, water and other companies for reinstating trenches, owing to the present high prices of materials and labour.

Mr. E. Willis, engineer and surveyor to the Chiswick Council, will read a paper, "Municipal Economy in War-time" at the next meeting of the association on November 6th.

Temporary Buildings for Military Purposes.

3.—SHELTERS FOR CHEST AND "GASSED" CASES.

By G. BERTRAM HARTFREE, F.A.I., Surveyor to the Alton, Hants, Urban District Council.

The most advanced form of natural treatment of disease is to be found in the open-air shelters provided for tuberculosis patients, the general principle of which is the provision of a building of three sides with the fourth open. Protection from the elements is provided—in one type by mounting the shelter on a turntable, which can be revolved according to the weather; another has a deep and roofed verandah to the open end, and facing the most favourable direction, the patient's bed being moved backwards and forwards as desired.

Possibly the many forms of shelters on the market have advantages for these cases, but for military hospitals they appear to leave much to be desired, there being many types sold at such prices that make it impossible for the vendors to supply a safe and substantial building. A thin matchboard of one thickness is used for external walls, the floors are not tongued, and the whole of the material is of similar character. Turntables require most careful construction as well as sound and substantial erection; otherwise when it is necessary to revolve the shelter the mechanism fails, and the patient's position is not a happy one. Two types have been designed to meet the difficulty where there is not a proportionately large male staff, and the patients require the best open-air treatment with protection from inclement weather.

Fig. 1 shows a shelter to take one bed. This I have found very useful for treating tuberculosis patients who have not thoroughly grasped the necessity of a thorough fresh-air treatment. There are no windows to the shelter, and lighting is obtained by raising flaps, one of which is provided to each side, and arranged so that either can easily be raised by the nurse, or any one or all of them can be opened at will. The gables consist of louvre ventilators, which are fixed, and consequently insure a continuous current of air. This type of shelter is portable, and when necessary can be taken apart in sections; the roof may be unbolted and moved as one part, and the four angles of the building are framed together and braced by iron ties, as shown in details of plates and angles.

The floor forms the base of the building, and consists of 4-in. by 2-in. joists with framed ends, and 1-in tongued and grooved boards securely fixed to them, the outside being finished by chamfered skirting. The framed angles are put in position, and wood ties with dovetailed ends are connected to angles, and further secured by stout screws or coach bolts; the boarding to complete under the flaps at the sides and one of the ends are dropped into position, and the roof placed and secured, and by hanging the half-door, as shown on conventional sketch, the building is completed. It will be seen from the sections that the flaps can be closed, or raised as sun screens, or lowered to throw off the rain.

Several years ago I had one of these constructed out of timber 4 in. by 3 in., and 4 in. by 2 in., using 1-in. matchboard and 1-in. tongued and grooved flooring, the roof being boarded and covered with felt well coated with tar. The cost was £12 18s.

Fig. 2 shows a shelter suitable for six or eight patients, and is made in sections to facilitate removal should it be necessary. The ends contain sliding doors (four in number) that are easily moved on rollers, and so arranged that the whole can be closed or any space up to three-quarters of the total width may be opened; ventilators are fixed in gables to provide a continuous air current.

The sides are closed by sliding shutters, the sill being hinged to allow of their being drawn up and placed in position; the sill is returned to its original place, and the shutter finally is lowered upon the sill, as is shown in detail of inside and section CD, leaving a space of 3 in. between top of shutter and underside of roof plate, which provides permanent ventilation sheltered by the overhanging eaves. The shutters are hung upon weights, provided with pivots that permit lines to pass through, and each shutter (except those at the end) is hung jointly with the next on each side. By first raising all the sills on each side, the action of raising one shutter would set the others in motion, and facilitate the work of closing a side should there be a sudden change of weather in a particular direction.

I recently received a quotation of £109 for a shelter as illustrated on Fig. 2, and detail drawing Fig. 3, the specification being as follows:

SPECIFICATION.

(1) The completed building is to be an open-air shelter resting on level paved on the ground. Upon these bricks transverse and cross joists will rest and be fixed together; the posts of building will be fixed to the joists and support the roof.

(2) The building is to be so constructed as to permit it being easily taken apart in sections as follows: The roof in three parts, the main floor in three parts, the sides each in three parts, and the panels of sides separately.

(3) The whole of timbers used on the works are to be well seasoned, and the best of their respective kinds, free from large or loose knots, sap, decay, or any other defects.

(4) All exposed faces, sides or edges of timber are to be wrought.

(5) All fixed internal timbers are to be so bevelled or splayed to prevent easy settlement of dust on them.

(6) (*a*) The name "American oak" shall apply to the wood known as Canadian, American, or Quebec oak (*Quercus Alba*). (*b*) The name "pitch pine" shall apply to either American pitch pine (*Pinus Rigida*) or Georgia pitch pine (*Pinus Australis*). (*c*) The name "yellow fir" shall refer to the wood called either yellow or red fir or deal (*Pinus Sylvestris*); wherever no other wood is specifically mentioned in this specification, it must be taken that yellow fir or deal is intended to be used. (*d*) Under no conditions whatever shall white deal be used for any internal or exposed work; the name "white deal" refers to the wood commonly known as spruce, white deal, fir or pine (*Abies Excelsa* or *Picea Excelsa*).

(7) Set out works and lay hard bricks to take bearing of main joists; such bricks shall be in single rows on each side of building, and to be placed under the ends of each main joist.

(8) Provide twelve sets of yellow fir main joists, 7 in. in depth, 2 in. in thickness, a "set" of main joists to mean one joist, except at two intermediate points to be decided upon. At these points a set shall consist of a pair of joists bolted together by ¾-in. iron bolts at each end, and at such position that they can easily be unbolted after the floor is completed.

(9) At distances not exceeding 12 in. apart, provide 3-in. by 2-in. fir cross joists, these to be securely spiked to main joists at every crossing. No cross joist is to overlap both joists forming the pair of main joists making a set (see Clause 8), but shall abut another cross joist at joint of the pair of main joists.

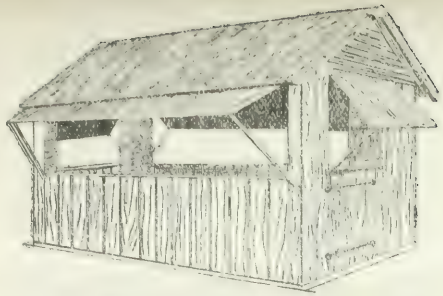
(10) Upon the cross joists lay and securely fix a wood floor consisting of pitch-pine boards, tongued and grooved and secret nailed. These boards are not to exceed 4 in. in width, or to be less than ⅞ in. in thickness.

(11) Secret nailing may be carried out by "chiselling up and glueing" where unavoidable; otherwise the nails are to be driven through the upper shoulders of tongues.

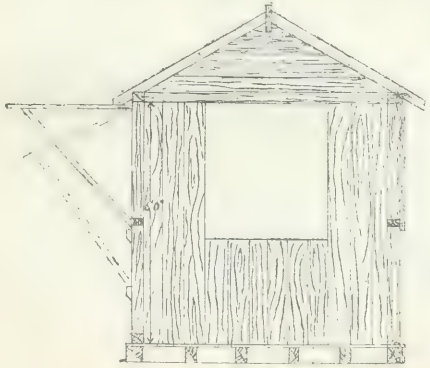
(12) Immediately over the joints of the two pairs of main joists named in Clause 8 two grooved boards shall be secured by straight iron tongues, so fixed as to allow easy removal of floor in sections.

(13) Clean off all projecting wood and leave a uniform and flush floor; carefully cover during course of works, and at completion well polish with two applications of Ronuk.

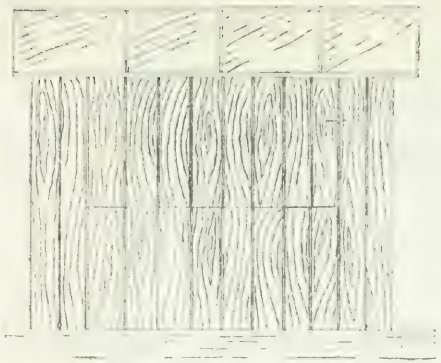
(14) (*a*) As shown on drawings, erect composite posts at corners, each 8 in. by 6 in.; at other points erect posts 6 in. by 4 in. (*b*) Posts are to be constructed as follows: Corner posts to consist of one 6-in. by 2-in. batten and two 4-in. by 2-in. battens, with intermediate pieces 1 in. in thickness; the intermediate pieces are to have tongues to fit in grooves in the battens; joints to be carefully fitted, painted together and securely fixed. (*c*) Other posts are to be constructed in a similar manner to corner posts.



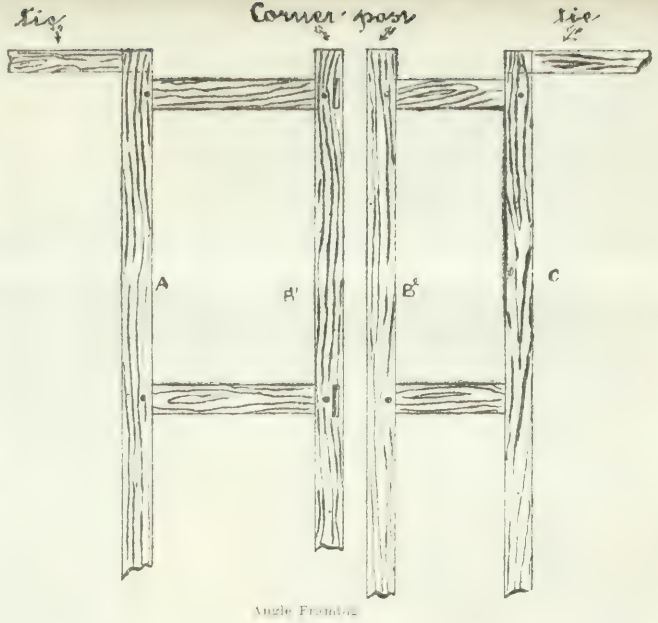
Plan.



Section



Elevation



Angle Frame.

Base.

Detail of Plate.

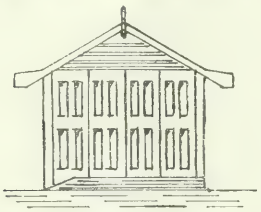
FIG. 1. SHELTER FOR ONE BE

but only two battens will be used—4-in. by 2-in. All posts are to be securely fixed to main joists, using not less than three coach bolts per post.

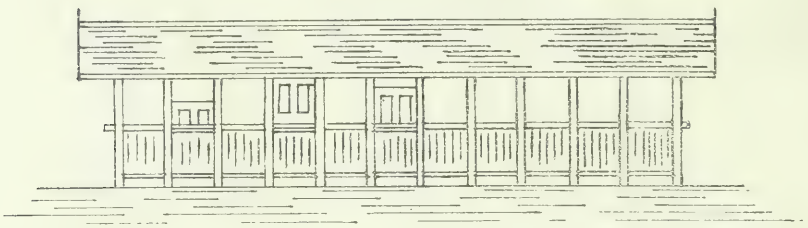
(15) Roof plates are to be 4 in. in width and 3 in. in depth to be morticed to receive posts, which are to be securely tenoned and screwed to them by stout screws, not less than 3½ in. in length. Plates are to be in lengths adapted to sectional work named in Clause 2.

(16) Rafters are to be 4 in. in depth and 2 in. in thickness. One main rafter is to be fixed over each post, and an intermediate rafter between each main rafter. All rafters to be securely fixed to plates.

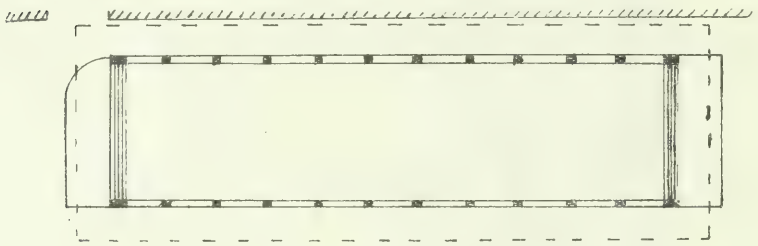
(17) In addition, two pairs of rafters are to be provided and bolted to main rafters as will be



End.



Side Elevation.



Plan.

Fig. 2.—Six-bed Shelter.

directed, and in such a manner as will allow easy removal of roof in sections.

(18) Sprocket pieces 1 ft. 9 in. in length, 5 in. greatest width, and 2 in. in thickness, are to be fixed to every rafter.

(19) Provide and fix as will be directed nine roof ties, the same to have the upper edges splayed off to prevent accumulation of dust.

(20) The rafters are to be covered by match-boarding ⅝ in. in thickness, not greater than 6 in. in width, tongued, grooved and V-jointed, fixed face downwards. All back projections to be arrissed across to form flat bed for Ruberoid roof covering.

(21) Where twin rafters occur (Clause 17), no roof board shall pass over two rafters, but will neatly abut the adjoining board at the joint between rafters.

(22) At each gable end provide and fix barge boards 1¼ in. in thickness and as detail drawings, and surmounted at intersection by a pediment scribed over ridge. Provide and fix brackets and corbels to support over-sailing plates, as shown on drawings.

(23) Red Ruberoid is to be used and fixed in accordance with the instructions supplied by the vendors. In addition, 6-in. strips are to be fixed over sectional joins to limit wastage upon removal of building; the contractor to provide four strips with nails and cement for future use.

(24) The ridge is to be first covered by a Ruberoid ridge, which, again, is to be covered by a bird's mouthed fillet with rounded edges, the whole to be painted with Ruberoid cement.

(25) Provide and fix in pairs 4-in. by 2-in. rails, tenoned and fitting into mortices in posts. Tenons to be pinned, except at two intermediate points, where they must be screwed.

(26) Provide and fix both inside and outside V-jointed matchboard ledged panels. The matchboard is not to exceed 4 in. in width, or to be less in thickness than ⅝ in. The ledges are to be not less than 3 in. in width or 1 in. in thickness, and are to be screwed on back of matchboard with the screw holes in ledges slotted, to allow shrinkage of wood without splitting. Completed panels are to be screwed into position on suitable fillets so fixed as to serve also as guides for shutters. Outside panels to finish neatly and below level of 3-in. joists. Inside panels to fit neatly to floor.

(27) Sills are to be American oak, properly weathered, grooved and throated, as shown on detail. The ends are to fit neatly between pulley stiles, and the shutter beads are to be cut to allow free play of sills. Sills are to be hung each on a pair of 3-in. back-flap hinges, and fitted to allow raising of shutters.

(28) (*a*) Construct shutters as shown on detail drawings; same to consist of 3½-in. by 1¼-in. stiles, muntins and top rails 7-in. by 1¼-in. bottom rails. The panels are to be not less than ⅝ in. in thickness, and on outside to show flush beads butted. The bottom rail is to be splayed ¼ in. on the top of inside edge. Shutters to be grooved and hung on strong flax lines to suitable weights, each provided with a pivot centre to allow adjoining shutters to balance on a single weight. To each shutter provide brass bush, wheel and faced axle pulleys, and one 3-in. sunk shutter lift, and one 3-in. drop shutter ring. (*b*) Construct in post linings suitable pocket pieces for weights.

(29) Plant on both sides of pulley stiles ⅝-in. by ⅜-in. shutter guides with chamfered edges.

(30) Construct in gable ends fixed louvre ventilators, as shown on detail drawings.

(31) (*a*) Provide and erect at both ends a set of four sliding doors, each with 4½-in. by 1¼-in. stiles, muntins and top rails, and 9-in. by 1½-in. middle and bottom rails. The inside upper edge of middle and bottom rails are to be splayed down a distance of ¼ in. The panels are not to be less than ⅝ in. in thickness, and on the outside to show flush bead, butted. (*b*) The doors are to be provided each with two friction door rollers, and these are to run on solid wrought copper-plated tracks. To prevent tracks from being an obstruction to foothold, the floor over which doors will run is to be so depressed that the top of tracks will be flush with main floor. (*c*) To the underside of lintol fix suitable door-parting slips. Provide and fix to each side of door two

3½-in. brass flush handles. To each door provide and fix one 8-in. brass lever flush bolt. Fit all stops, guards and beads, and leave in running order.

(32) Provide and fix at each side 3½-in. half-round guttering with stop ends and an outlet, the whole to be well supported by iron brackets secured to the rafters.

(33) Provide and fix to each outlet suitable 2-in. swan-necks, and a short length of down pipe to be secured to same.

(34) Provide and set as will be directed two suitable burnt-out barrels as water butts.

(35) Provide and fix at each end a stout sloped staging, consisting of 1-in. floor boards nailed to tapered fir bearers.

(36) (*a*) The whole of the external woodwork, including stagings and water butts, is to be treated with two coats of medium brown-coloured Solignum. (*b*) All nail holes, &c., are to be filled with special Solignum putty. (*c*) The whole of the internal woodwork, excepting the floors, is to be treated with one coat of Solignum, a coat of Solignum stopping solution and a coat of Solignum varnish. Finished colours to be: Inside panels, matchboard and louvre boards, light yellow; posts, rails, stiles, muntins, rafters, ties, light brown.

(37) Paint all guttering, both inside and outside, four coats good oil paint of an approved tint. Paint all swan-necks and guttering four coats good oil paint of an approved tint.

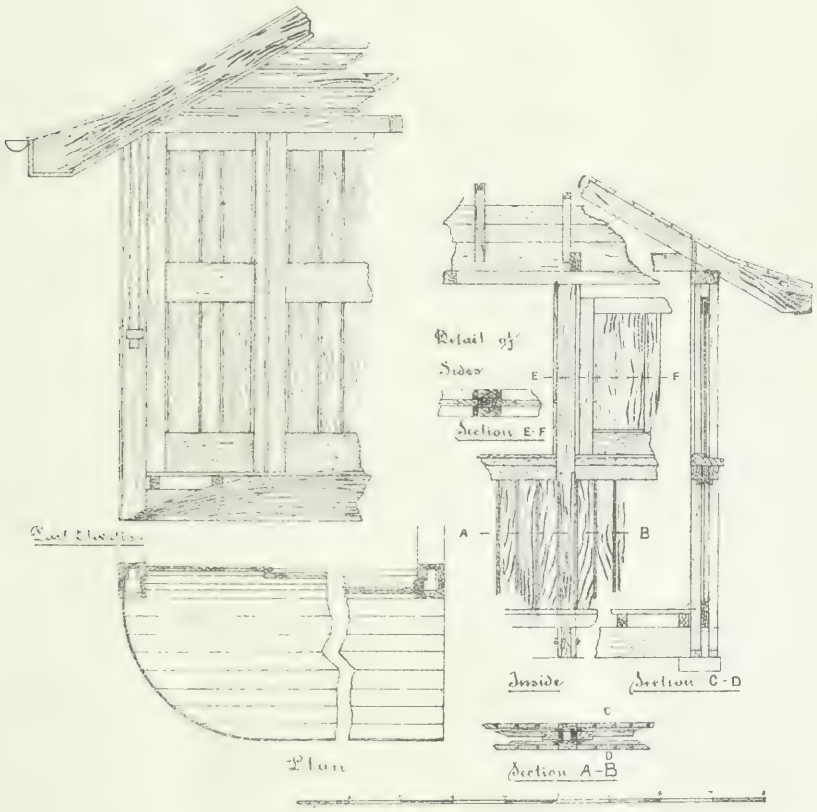


Fig. 3.—Six-bed Shelter: Working Details.

The Monaghan Appointment.—Hugh M'Cague, a mason, has again been elected to the position of engineer to the Monaghan Rural Council. He was elected to the position a month ago, but the Local Government Board refused to sanction the appointment on the grounds that he did not possess the requisite qualifications. At Tuesday's meeting when the appointment—to which editorial reference was made in our issue of last week—was being discussed, there was some lively interchanges among the members.

A MODERN EUCLID ON BOARDING HOUSES.

The following definitions, axioms and propositions are said to have been written some years ago by Stephen Leacock, a Canadian barrister, and are worthy of reproduction at the present time, when the Canadians are setting such a brilliant example to their Mother Country:—

DEFINITIONS AND AXIOMS.

(1) All boarding-houses are the same boarding-houses.

(2) Boarders in the same boarding-house and on the same floor are equal to one another.

(3) A single room is that which has no parts and no magnitude.

(4) The landlady of a boarding-house is a parallelogram—an oblong, angular figure, which cannot be described, but is equal to anything.

(5) A wrangle is the disinclination to each other of two boarders who meet together but are not on the same floor.

(6) All the other rooms being taken, a single room is said to be a double room, which is absurd.

PARTICULARS AND PROPOSITIONS.

(1) A pie may be produced any number of times.

(2) The landlady may be reduced to her lowest terms by a series of propositions.

(3) A bee-line may be made from any one boarding-house to any other boarding-house.

(4) The clothes of a boarding-house bed, though produced ever so far both ways, will not meet.

(5) Any two meals at a boarding-house are together less than one square meal.

(6) On the same bill, and on the same side of it, there shall be two charges for the same thing.

"A. J. M."—We would recommend "Structural Economy," by E. A. Slater (St. Bride's Press, Ltd.).

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Itchen, Oldham; housing—Dublin, Weymouth; refuse disposal—Aylesbury; roads and materials—Chertsey, East Sussex; sewerage and sewage disposal—Acton, Cork; water, gas and electricity—Bishop Auckland, Ivybridge, Lancaster, Portrush. Particulars of other projected works will be found under the "Local Government Board Inquiries" page.

BUILDINGS.

Barking U.D.C.—The surveyor, Mr. C. F. Dawson, has received instructions to prepare plans for the proposed extensions to the electricity works, for which loan has been sanctioned.

Coventry T.C.—It has been agreed to carry out improvements at the Holmsdale-road police-station at an estimated cost of £295.

Halifax T.C.—The Tramways Committee recommend the erection of a waiting-room at Stump Cross.

Itchen U.D.C.—It has been resolved to build an isolation hospital, at an estimated cost of £3,125, the money to be paid out of revenue.

Oldham T.C.—The Education Committee have received the sanction of the Board of Education to the building of an infants' school at Northmoor.

Romsey T.C.—Tenders are being invited for the erection of two public conveniences.

Surbiton U.D.C.—A fire which broke out last week at the sewage works in Lower Marsh-lane destroyed the roof of the boiler-house, but was prevented from doing further damage to boilers or machinery, or an adjoining building. The damage, which is covered by insurance, is roughly put at £1,500.

HOUSING AND TOWN PLANNING.

Dublin T.C.—The city council on Monday last adopted a report from the Housing Committee recommending that the sum of £8,000 be included in next year's estimates for the erection of working-class houses on a portion of the Ormond Market site.

Glasgow T.C.—The provision of houses consisting of not less than one room and kitchen, with bath-room, has been referred to a special committee, with power to consider whether they should be built upon corporation land or upon land to be purchased or leased.

Wednesbury T.C.—The council on Monday last adopted a report dealing with the difficulty in which the corporation was placed by the Local Government Board having refused to sanction a loan for the erection of twenty-four artisans' dwellings after the council had completed the purchase of the site and the erection of a number of the houses had been completed. It was stated that, as a result of negotiations, the contract for the purchase of the land was to be rescinded, and the vendor had agreed to convey a portion of the land, to be maintained by the council as an open space, on condition that the council carried out their original proposal to construct a new road to form an approach to the new building site. The contract for the erection of the houses was also to be rescinded, but the council proposed, after the war, and subject to the consent of the Local Government Board, to purchase for £1,760 the eight houses which had been erected.

Weymouth T.C.—A sum of £10,000 has been voted to the corporation by the Government towards a housing scheme for munition workers.

Wrexham R.D.C.—The Broughton housing scheme has been postponed for the present.

REFUSE COLLECTION AND DISPOSAL.

Aylesbury U.D.C.—The question of erecting a refuse destructor in connection with the electric power station has been referred to the engineer, Mr. W. H. Taylor, and the electrical engineer.

ROADS AND MATERIALS.

Banffshire C.C.—A report has been submitted by the County Road Board stating that the reconstruction of part of the Banff and Aberchirder road had been completed at a cost of £3,920, or £980 per mile. By doing the work without a contract a saving of £321 had been effected, and tools to the value of £70 had to be taken over. One-half of the cost of the road was to be met by a grant from the Road Board.

Chertsey R.D.C.—The War Office have offered to provide money for the repair of the military roads at Chobham.

Croydon T.C.—Negotiations are in progress for the purchase of land, at a cost of £2,250, for the improvement of bad corners between Waddon Park-avenue and Waddon Court-road.

Devon C.C.—The council have rejected a report by the Main Roads Committee on the steps that should be taken to ensure the proper supervision of the work of maintaining and repairing the main roads in the Barnstaple Rural District. This stated that it was the duty of the district surveyor to supervise the work on 118 miles of main roads and 426 miles of district roads, involving an expenditure of over £15,000 a year, and the committee were strongly of opinion that it was impossible for one man to carry out the work in such an area either efficiently or economically. They recommended the county council to relieve the rural district council of the duty of maintaining certain main roads, and the county council to do the work themselves by direct maintenance. Mr. Hurrell, moving the adoption of the report, said the proposal was to take over 70 miles of main roads, leaving Barnstaple with 48 miles. Obviously, the taking over of these roads by the county would involve no capital expenditure, as the county council were already doing the Bideford roads by direct labour, and had the necessary tools and apparatus. It appeared that the rural council, which objected to the committee's proposal, had deferred the appointment of a second surveyor until after the war, and they claimed that in this they were acting in accordance with the instructions of the Government not at present to appoint to office a man who was eligible for the Army.

East Preston (Sussex) R.D.C.—The surveyor, Mr. C. W. Leney, having suggested that several roads which had been damaged by the rains should be repaired with an extra quantity of flints in the spring, Mr. Schweder suggested that, to make a good permanent job, they should fill in the ruts with granite, or use Tarmac. He referred to the great improvement made by the surveyor in Goring-lane. At one time, he said, that road was "simply a mud track," and now it was a splendid piece of road, and a great object-lesson as to what could be done to make a bad road into a good one. He gave the surveyor all credit for it. If more roads were treated in the same way they would save a great deal of expense in the future.

East Sussex C.C.—The Roads and Bridges Committee on Tuesday last submitted correspondence with the Road Board as to the construction and improvement of the road from Newhaven to Seaford, at a cost of £10,589. In this the Road Board stated that they could not entertain a suggestion by the military authorities to divert the road, this being principally on the ground of cost, but also because the present road had a much better foundation than could be provided by the alternative road. The board hoped that when the new road was completed the county council would agree to main it, and that it would become a Class I. road.

Hampton Wick U.D.C.—The tender of Messrs. W. Bennett & Co., at £10 4s. 6d. per 1,000, has been accepted for the supply of 5,000 wood blocks.

Leek U.D.C.—It is proposed to carry out paving and channelling repairs in several streets.

Ely U.D.C.—The council recently decided to whiten the kerbs of street corners with a view to lessening the danger from darkened streets at night. In the course of the discussion Mr. Burrows said that if they whitened the pavement in one street they would have to do the work in all streets. Not only that, if they had wet weather, the surveyor and other officials would be running about from morning to night rewhitening the pavements where it had been washed off by the rain. It would be a waste of time and money. The chairman, Mr. W. Cutlack, thought the whitening would not wash off so easily, being a special composition.

Kingsbury U.D.C.—The chairman reported that in company with the surveyor, Mr. R. C. Newton, he had made a thorough inspection of the roads of the district, and found that, with the heavy traffic they are now called upon to bear, combined with the wear and tear which had been put upon them by the horses stabled in the various Army remount departments in the district, much repairing was necessary, and in some cases very urgent. This, he feared, would be very expensive owing to the difficulty of getting material and its high cost. In 1912 a portion of the Kingsbury road near Kingsbury Green was resurfaced with Tarmac by Tarmac Company, Limited. This road had been liable to the council for the maintenance of this portion of the Kingsbury road up to last month; that liability had now ceased. The work had stood exceedingly well, and was well suited for the district, and it was to be regretted that the Middlesex County Council did not see their way to accept this form of macadam as suitable for this road, thereby preventing the council going further with this material.

Manchester T.C.—At present the city is divided for highway purposes into five districts—Northern, Central, Eastern, South-western, and South-eastern. Each district is under the care of a sub-committee. In future it is proposed to have six districts, the new one to be called the Southern district. The added district will consist mainly of the present Withington area. For purposes of convenience and equalisation of areas portions of the old district will be annexed to the two adjoining districts.

Merthyr T.C.—The town council have deferred the consideration of a report by the borough engineer and surveyor, Mr. A. J. Marshall, on the subject of war economies, which amount already to a total of £1,049 in respect of labour. Mr. Marshall stated: "It must be remembered that, in order to maintain your highways, main roads, and sewers in the efficiency which we find them to-day the present staff is not over-strong, and when it is considered that at the present time we are much below the number of men which were allotted to each district after the dismissal of the thirty employees in 1912, I would strongly urge that before any drastic measures are adopted the whole of the pros and cons should be carefully discussed. You are doubtless aware that the borough, during the last decade, has grown beyond recognition, and the ever-increasing traffic is such that calls for more careful and improved roadway construction. With the growth of the borough comes its attendant evils—viz., the super-imposed strains upon the sewage carrying capacity of the mains, which in times of heavy rainfall is as much it not more than your system can carry, and it is with much difficulty that your obligations are fulfilled. During the last twelve months certain employees have resigned to join his Majesty's Forces, and bearing in mind the economies which are necessary in these abnormal times it has been my constant endeavour to carry on the needs of the borough without filling vacancies, first having regard to the health of the borough."

Norfolk C.C.—The county surveyor, Mr. T. H. B. Heslop, reports that it appears most unlikely that the council will be able to obtain anything approaching the full quantity of granite allowed for in the estimates. Under these circumstances the more important roads must suffer considerably, more especially as the traffic upon them, both for ordinary and military purposes, has so much increased. The whole of the work upon the military road and the various camps in the county carried out for the War Office is now completed.

Romsey T.C.—It was reported by the Sanitary Committee that no tenders had been received for hauling, scavenging, and street watering, and in the circumstances the council resolved to supply its own team labour, giving authority to the committee to purchase the necessary horses.

Strood R.D.C.—An improvement is to be carried out at the lower end of Wainscot, Frindsbury, at an estimated cost of £125, towards which the Road Board will make a contribution of 75 per cent, and the county council a moiety of the remainder.

Walsall R.D.C.—Referring to the Birmingham and Walsall road, Mr. Carter (Rushall) said the neglected condition of the road had been very unfair to the district council, as motorists were now using the by-roads and driving over Barr Beacon in order to reach Birmingham. This meant that the district would be put to extra expense for the upkeep of the roads for which they were responsible simply because the county road had been allowed to get out of repair. The chairman, Mr. E. H. Barratt, who is a member of the county council, said the County Roads Committee had recently paid a visit of inspection to this road, and it was now being greatly improved.

Weybridge U.D.C.—It was agreed recently to levy a rate of 1s. 7d. in place of 1s. 6d., as proposed by the Finance Committee, in order principally to improve the condition of the roads, which were stated to be getting into a bad state.

Worthing T.C.—Councillor Gardiner, in submitting the report of the Highways Committee, assured the council that the necessity for economy was well in mind. The attention given at intervals to the tarred roads was not extravagance, but economy. The surveyor, Mr. F. Roberts, had specialised on these tarred clinker roads, and there were some 12 miles in the borough. They hoped to extend them, and this would be done without extra cost. For the last 10 years the tarred clinker roads had cost no more than they did before, and they had received very many compliments as to their satisfactory condition.

SEWERAGE AND SEWAGE DISPOSAL.

Acton U.D.C.—A report has been submitted stating that Sir Alex. Binnie had been instructed by a committee to include in his plans and estimates for extending the relief sewer along Willesden-lane provision for the drainage of the large factories now being erected in that thoroughfare. The report further stated that the committee had also instructed him to report separately on the cost of providing a sewer to bring the storm water from Old Oak Common-lane district to the sewage pumping station at such a level as to discharge the storm water into the sewer of the London County Council by gravity. At present the storm water from that area had to be pumped up at the sewage pumping station and the new sewer would materially reduce the annual costs for pumping. The council was now informed that it was proposed to make a fresh route for the northern relief sewer, and that the matter would be considered at the next meeting of the committee.

Cork T.C.—The city surveyor, Mr. J. F. Delany, presented a report on the work in connection with sewers.

East Grinstead U.D.C.—It was reported on Monday [illegible] the [illegible] of the [illegible] had already £426 [illegible]

Naas U.D.C.—The council have approved the plans of the sewerage scheme, and forwarded them to the Local Government Board for approval.

Nantwich U.D.C.—While approving the amended plans of the sewerage scheme, the Local Government Board intimate that the execution of the work must be postponed.

Portland U.D.C.—Certain necessary repairs to the Chesil sewer outfall are to be carried out by Messrs. James A. Baker, at an estimated cost of £420.

WATER, GAS, AND ELECTRICITY.

Bishop Auckland U.D.C.—It has been agreed to [illegible] the [illegible] Hill water [illegible]

Brighton T.C.—The electricity engineer presented a report stating that the installation of electric light in the artisans' dwellings in Tillstone-street has now been in use for a complete twelve months to June last, that installations have been fitted in forty-four of the houses with a total of 278 lamps, supplied by fifteen services off the mains, that the total revenue derived was £49, and that the average cost to each house worked out at 5d. per week. The committee have decided that dwellings not yet wired for electricity are to be wired as they become empty.

Cheltenham T.C.—The last report of the electricity undertaking, which included eight months of the war period, showed a nett profit of £1,043.

Edinburgh T.C.—The city council on Tuesday approved a recommendation by the Electric Lighting Committee to accept the tender of Messrs. Vickers, at £23,251, for turbines and alternators for the new power station at Portobello, and a tender at £7,611 for condensing plant. The chairman of the committee said they were advised to accept the tenders now, as, according to expert opinion, material would be dearer after the war.

Erith U.D.C.—The tender of Messrs. Fraser & Chalmers, at £10,432, has been accepted for the supply of a turbo-alternator and condensing plant for the electricity works.

Horsham R.D.C.—The Local Government Board wrote asking the council to consider the desirability of taking action, with a view to continuing the supply of water for Broadbridge Heath by endeavouring to obtain a lease of the North Sussex Gas and Water Company's undertaking. The council subsequently, in committee, considered terms for an expert report upon the undertaking.

Ivybridge U.D.C.—The seal of the council has been affixed to the loan of £4,000 for the new waterworks scheme.

Lancaster T.C.—Application is to be made for a Provisional Order for the extension of the gasworks, at an estimated cost of £80,000.

Lurgan U.D.C.—It was announced on Monday that the Treasury had withheld their consent to the council borrowing £50,000 for the purchase of the gasworks, which were to have been taken over on October 1st by the council, and that arrangements had been made with the directors of the gas company to continue running the works for the present.

Portrush U.D.C.—An intimation has been received from the Board of Trade giving consent to the proposed generating station for the council's electricity supply works.

Stepney B.C.—The Electric Supply Committee reported recently that the increase in the income of the electricity undertaking last year was £7,197 upon the total of the previous year. There would be carried to nett revenue account £45,000, compared with £44,387 in the previous year. The average price per unit for lighting purposes was under 2d., and for power purposes under 1d.—cheaper, a councillor stated, than at Chicago, which was generally known as the model electric city.

MISCELLANEOUS.

Axminster U.D.C.—The council have rejected a recommendation to repair the six seats on the highway, it being stated that "no one could sit on the highway in the fine weather owing to the dust." All the seats in the urban area are to be removed and stored.

East Sussex C.C.—A report with respect to sea defence works at Rottingdean and Saltdean, for which a sum of £5,000 had been previously voted, was submitted by Alderman Godwin King, who stated that the Roads and Bridges Committee had decided that it would be advisable to dump more shingle. Eighteen months ago the council authorised £200 to be spent experimentally in this way, and the shingle was dumped beside a particular wall. Several members inspected the works, and were all impressed with the advantage of dumping shingle as a means of protecting the existing works. The committee had therefore authorised the chairman and vice-chairman to buy or arrange for the dumping of more shingle as they thought fit, with the proviso that the total amount to be expended on the existing contract and on the dumping of shingle must not exceed the £5,000 voted by the council.

Weybridge U.D.C.—It has been agreed to obtain estimates for the supply of 1,000 ft. of fire hose with instantaneous couplings.

"Golden Dustman's" Romance.—"The Golden Dustman" is dead. Mr. Charles Murrell, the man who is said to have made a fortune out of the contents of London's dustcarts, was given the title for a very different reason that Dickens gave it to Nicodemus Boffin in "Our Mutual Friend." The real "Golden Dustman," we read in the *Weekly Dispatch*, took a little strip of land running down to the water's edge a few yards from Blackfriars Bridge some twenty-five years ago. He also bought one or two of the barges that drift silently on the tide down to Barking. Then he started to create the business that made him famous. There were other competitors in the field, but gradually he got a footing, and secured contracts for taking away tons of refuse from those London boroughs which are unable to dispose of their refuse like other authorities further away from the City. Soon, instead of shifting a few hundred tons, he was moving thousands of tons a week. His flotilla of barges grew into a large fleet manned by large numbers of the famous race of Thames bargemen. There came streaming into Upper Ground-street to his wharf the dustcarts of London. Recently the "Golden Dustman" has been shifting in his eighty barges about 1,000 tons of refuse a day—something like 250,000 tons a year! With the death of the "Golden Dustman" goes one of the romantic figures of modern London—a figure such as only London could have created.

PERSONAL.

Mr. Stephen MacDonagh has been appointed assistant county surveyor of Leitrim.

Mr. W. J. Edwards has been appointed surveyor to the Abergele Urban District Council.

Mr. W. J. Goode, surveyor to the Buckfastleigh Urban District Council, is about to take up a similar position at Street.

Mr. W. A. Jackson, surveyor and inspector to the Malton Urban District Council, has been voted an increase of salary.

Mr. William Hendry, burgh surveyor of Buckie, has been appointed to the additional post of sanitary inspector, at an increase of £10 to his salary.

Mr. A. P. Horsley, borough engineer and surveyor of Hartlepool, has been appointed architect to the education authority, and has had his salary increased by £50 per annum.

Mr. T. L. Hustler, borough surveyor and engineer of Shoreditch, who has been appointed a lieutenant in His Majesty's Forces, has been presented with a service sword and a full camp kit, as a mark of esteem from the officials at the town hall.

Mr. R. K. Halls, chief clerk in the offices of Mr. F. W. Pearce, surveyor to the Twickenham Urban District Council, who has been granted permission to join His Majesty's Forces, is the only remaining member of the surveyor's permanent staff, four being already absent on service. The council are at present paying to members of the staff war allowances to the extent of £1,000 a year.

Mr. W. G. Cross, assistant borough surveyor, Richmond, Surrey, has recently received a commission as captain in the 5th Labour Battalion, Royal Engineers, and is now on active service in France. Mr. A. J. Mahoney, clerk in the borough surveyor's office, has also received a temporary commission in the Indian Army, having been transferred from the 6th East Surrey (Territorials), which regiment has been in India for several months.

The recent death of Sir Thomas Bucknill, the famous and popular judge, reminds us that exactly ten years ago his son, Mr. Alfred Bucknill, married Miss Boulnois, one of the daughters of the well-known municipal engineer, Mr. H. Percy Boulnois. Mr. Bucknill is a barrister, but early in the war he applied for and obtained a commission in the Surrey Yeomanry, and is now a Captain in that regiment, which may at any time be ordered to the front.

OBITUARY.

Mr. John H. Chubb, who until recently held the position of surveyor and sanitary inspector to the East Kerrier Rural District Council, died recently, we regret to state.

Second-Lieutenant Anthony Walter Brook Kitchen, 7th Royal West Surrey Regiment, only son of Mr. Brook Taylor Kitchen, the architect to the Local Government Board, was, we regret to state, killed while on active service in Flanders on September 25th.

The Civic Engineer's Who's Who, compiled by the editor of The Surveyor and Municipal and County Engineer, for a second annual issue is remarkably complete. The biographical matter is full and methodically arranged. The book is published by the St. Bride's Press, Limited.—*Liverpool Courier.*

Walsall Improvement Scheme Vetoed.—It is understood that the Local Government Board have intimated that they cannot see their way to sanction the scheme submitted to them by the Walsall Town Council for widening Lower Bridge-street—one of the principal business thoroughfares of the town—at a cost estimated at £40,000.

St. Asaph Surveyor and His Staff.—At the St. Asaph (Flint) Rural District Council recently, a discussion took place in regard to the power of the highway surveyor, Mr. J. Lloyd, over the men. The surveyor said that as things were at present he had little or no authority over the men, who for the most part simply considered him his equal. Formerly he had full control of the men for twenty years or more, but since the council as a body had exercised the control he was looked upon by some as a sort of nobody, and he confessed it made him look rather small. It was eventually decided that the surveyor should again have full control over the men.

CANDY FILTERS AT WINDSOR.

[illegible]

The Candy Declor system of bacterial purification has been adopted to ensure the purity of the water supply of the borough of Windsor, as also to Eton (including the college), and to the troops in the district, and the installation was recently formally put into operation in the presence of the mayor, the deputy mayor, aldermen, councillors and officials, including the borough surveyor and waterworks engineer, Mr. E. A. Stickland, and the medical officer of health. Among the visitors were the chairman of the Eton Urban District Council, the chairman of the Reading Waterworks Committee, and Mr. F. Pullen Candy (of the Candy Filter Company, Limited).

Prior to the opening ceremony, the mayor, Mr. Councillor W. Carter, entertained the assembled company at luncheon, and in the course of his speech referred to the kindness and courtesy of the Reading Corporation in permitting the Windsor Corporation to investigate the Candy filtration system as used by that town with such success.

The chairman of the Reading Waterworks Committee, Mr. Alderman T. B. Parfitt, in an interesting

Candy Filter Installation at Windsor.

speech, described the Reading water supply (which is taken from the navigable river Kennet), and set forth the reasons that led to the adoption of the Candy Declor filters by his town.

The installation at the Windsor waterworks consists of six patent Candy Declor pressure filters; each filter is 8 ft. 3 in. internal diameter by 18 ft. high, and is constructed of mild-steel plates to withstand a working pressure of 100 lb. to the square inch.

The filters have been laid down by the corporation in order to ensure that the water shall, from a bacteriological point of view, be always as safe and excellent as it is chemically and physically. The function of the Declor filters is to destroy any pathogenic bacteria that may accidentally obtain access to the wells, and so to safeguard the health of the borough in this particular direction.

The destruction of the pathogenic bacteria is effected by the addition to the water, previous to passing through the filters, of a minute dose of a solution containing free chlorine.

It is now an admitted scientific fact that, with an ordinary good drinking water, the addition of 1 part of free chlorine to 1,000,000 parts of water will absolutely ensure the destruction of the pathogenic bacteria responsible for water-borne disease.

This exceedingly small quantity of free chlorine, although so deadly to the bacteria, is quite harmless to human beings; but as, for various reasons, it is not advisable that a public water should contain free chlorine, the Candy Declor filters are so constructed that the free chlorine is eliminated after it had destroyed the objectionable bacteria.

The Windsor water supply is obtained from wells on Tangier Island, the water from the wells being pumped by hydraulic or electric power, as the case may be, into the mains. The water, however, does not now go direct into the mains from the pumps, but is diverted, so that it first passes through the Candy Declor filters.

A low-pressure turbine is placed in the 12-in. pipe leading to the filters, this turbine being so constructed that its speed of rotation is proportionate to the volume of water passing at any given time. A small ram pump (provided in duplicate) is worked from a counter-shaft driven by the turbine, and this ram pump is continually injecting into the water passing to the filters a solution of calcium hypochlorite, so that the water here receives its correct dosage of free chlorine. The solution of calcium hypochlorite is contained in a small tank, and the ram pump draws direct from the solution tank, which is also in duplicate.

After its chlorination the water flows along the filter mains, and by branches is sub-divided and passes equally into the filters, each of which is arranged for dealing with up to a maximum of 8,000 gallons per hour, so that the installation is capable of dealing with well over 1,000,000 gallons per twenty-four hours.

The treated water enters the filters at the top, and, after passing slowly down through them, flows through branch pipes from the bottom into a branch main, and thence to the town supply.

The upper part of each filter contains a bed of silica sand and gravel, which serves as a protecting layer to the dechlorinating bed that is placed in the lower part.

In addition to containing the silica bed, the upper and middle part of each filter is arranged to act as a contact tank, so that the free chlorine remains in contact with the water for a period of about half an hour from the time of entering the filter to the time the chlorine is eliminated. This elimination takes place in the dechlorinating bed, which is situated in the lower portion of the filter. The active dechlorinating agent is a special granular insoluble carbonaceous material which rests upon graded layers of silica, supported, like the silica sand bed, on a perforated floor.

The filter contains sufficient of the dechlorinating material to last for a year's working, and when fresh material is required the old can be readily removed through manholes provided for the purpose, and fresh sections put in at [illegible] that can be performed in a few hours.

Sampling taps are provided from which the water can be drawn before and after treatment, so that tests of the process can be made at any time.

The patent Declor filters (of which the Candy Filter Company, Limited, Westminster, London, are the sole makers) have been adopted by many important towns. The War Office have also adopted the Candy Declor filters for the supply in bulk of water to various camps.

The Royal Sanitary Institute of Great Britain presented, in 1913, their highest award—the Silver Medal—to the Candy Filter Company for the Declor process after a long and searching investigation conducted by their judges, comprising some of the most eminent engineers and scientists of the day.

Women Tram Conductors.—Following the example set in other departments of the public service, the Tramways Committee of the Nottingham Corporation propose to employ women conductors as an experiment. They will receive the full rate of pay which [illegible] men at present get.

Chadwick Public Lectures.—"Emergency Military Hospital Construction" will be the title of a Chadwick Public Lecture to be delivered at the Royal Institute of British Architects on Wednesday, November 10th, by Mr. A. Saxon Snell, F.R.I.B.A. On the following Wednesday, November 17th, at the Royal Sanitary Institute, 90 Buckingham Palace-road, S.W., Mr. W. E. Riley, F.R.I.B.A., superintending architect to the London County Council, will be the lecturer, and will submit "Some Conclusions on Housing our Workers." At both lectures the chair will be taken at 8.15 p.m. Admission will be free.

"Dowsing" in the Dardanelles.—Along a certain section of the trenches in Gallipoli, a R.A.M.C. officer just back tells me (says a writer in the London *Evening News*) there was a great scarcity of water, and the officer in charge was a little perplexed when one of his "Tommies," a sturdy Welsh miner, undertook to procure a good supply. Cutting a sapling for divining rod, the miner proceeded to "dowse" over some dead ground behind the post. His air of confidence was amazing, and only a few minutes elapsed before he jerked his twig down and said laconically, "We'll dig here." He and his chum would accept no help, but straightway commenced digging operations, and were rewarded a few feet down with a good supply of water.

MUNICIPAL WATERWORKS ASSOCIATION.

ANNUAL MEETING IN LONDON.

The annual meeting of the Municipal Waterworks Association, which has now completed the fourth year of its existence, was held at the offices of the Metropolitan Water Board, London, on Friday last, Councillor Archibald Campbell, chairman of the Glasgow Water Committee, who has held the office of president during the past two years, occupying the chair. The report of the executive committee shows that the membership of the association has now reached 132, representing forty-seven municipal water authorities responsible for the supply of water to a population of 17,000,000, and involving a capital expenditure of some £108,000,000. Hitherto membership has been restricted to representatives of municipal corporations or water boards in the United Kingdom supplying water to populations of over 50,000, but at Friday's meeting it was decided that representatives of authorities supplying populations of over 20,000 should in future be eligible for election.

Referring, in the course of an address, to the recently issued Government return as to water undertakings in England and Wales, Councillor Campbell expressed the opinion that this document contained the beginnings of a department of the Local Government Board which would presumably lead up, sooner or later, to the mapping out of this country into watershed areas on the lines of the recommendations of several Royal Commissions and Select Committees of the past. But it was to be feared, he added, that the war was going to interfere in many ways with many matters of progress and reform in the domestic affairs of the country, and it would be left for many years to come to the different authorities and localities to safeguard their own interests. If this prognostication were sound there would appear to be all the more reason why the association should continue to enlarge its activities with a view to mutual protection, instruction, and support of the objects for which the organisation was formed. The incidence of taxation of water undertakings by local authorities was one of the matters that had engaged the attention of the executive committee during the past year. The practice in Scotland was that these undertakings, as in the case of similar classes of municipal undertakings, were rated on their whole value by county authorities and on one-fourth the value by burgh authorities. This system was uniform in Scotland, but in England the practice was almost as varied as the undertakings themselves, and no uniform system of rating prevailed. He thought it might be a matter for the representatives of such undertakings in England to move towards obtaining a fair, equitable, and uniform system, having in view something even better than that in practice in Scotland, in which case he had no doubt Scotland would find it easy to participate in the improved conditions.

NEW PRESIDENT'S ADDRESS

Lieut.-Colonel Porter, chairman of the Liverpool Corporation Waterworks Committee, was elected president for the ensuing year.

Returning thanks for the honour conferred upon him, he remarked that the terrible disasters that had overwhelmed civilisation would have the effect very largely of curtailing our domestic legislation, especially in the direction of the national conservation of the water supply of the three kingdoms. This ought to strengthen the intention of the Municipal Waterworks Association not only to safeguard our mutual interests, but to endeavour to bring some harmony and concord where otherwise there might be dissensions and conflicting interests in the scramble for water sources, to avoid the wasteful expenditure of public money on Parliamentary counsel and expert witnesses in the committee-rooms at Westminster, and to prevent as far as possible wasteful litigation.

The hanging up of legislation, the president went on, would appear to indicate the desirability of this association enlarging its sphere of influence. It might be said with truth that the number of subjects in which the smaller authorities were in accord with the larger authorities was much greater and more important than those subjects where there might not be a complete sympathy, and it would appear to be desirable that the association should be a forum both for the concentration of effort where general unanimity prevailed, and for the removal or smoothing down of difficulties where local interests might be thought to clash.

One result which would flow from such a policy would be that the waste of ratepayers' money in private Bill legislation might be largely avoided, for it would be quite possible for the association to arrange amicably for the proper allocation of water supplies or the framing of en route clauses or bulk supplies without fighting the matters out in the most expensive manner possible—namely, by learned counsel and the expert witnesses.

Still another feature for mutual usefulness and the safeguarding of the ratepayers' purse was suggested in the matter of litigation. Having regard to the extraordinarily complex condition of water legislation, both local and general, litigation must arise; but it seemed to be unfair that one unhappy water authority, where some particular point had happened to crop up, should be called upon to fight perhaps a very important principle right through to the House of Lords, not only for its own benefit, but for the benefit of scores of other authorities. It ought to be possible so to arrange through the association, when any legal dispute of a general nature arose, that some effort should be made to spread the expense over all those who were concerned in securing a satisfactory decision.

He also hoped to see the association extending its activities in the direction of securing a little more uniformity, not only as regarded charges under all its several heads of domestic, non-domestic, meter, trade and bulk, but also with a view to the presentation of accounts in a form that would permit of something approaching standardisation.

The question of securing a standard form of water analysis had been before the association, and it was to be hoped that in the near future the co-operation of the chemical and bacteriological experts would enable something to be done in this direction.

The vexed question of the basis of rating waterworks would also require further consideration, especially in view of the Metropolitan Water Board's dispute with the Chertsey Union, although the different terms upon which money could be borrowed in the future must change the aspect of this particular subject.

The future had indeed a large number of problems before it—engineering, scientific, financial, Parliamentary, legal, and administrative—and it was with a conviction that the association would prove itself to be of considerable utility, not only to the membership, but to the nation at large, that he took some pride in accepting the presidency of the association.

Obstructions in Sewers.—The Worsley Urban District Council have recently experienced considerable trouble through one of their 18-in. sewer mains in Walkden-road becoming partially blocked up. Rods, chains, &c., were used, but were of no avail. The sewage had risen to a height of 8 ft. in the manhole chamber owing to the heavy rain and the blockage in the sewer. Mr. Howard, the surveyor, secured the loan of Caine's sewer plough and cleanser from the Eccles Corporation, and although the distance between the manholes was 104 yds., the obstruction was cut through in a very short time with the machine. Mr. James Caine, the Eccles drainage inspector, took charge of the operations, and was complimented on the efficiency of the machines which he has invented.

Local Authorities' Economies.—The President of the Local Government Board was asked in the House of Commons whether the reports asked for by his circular letter of August 4th, as to the nature and extent of any savings which local authorities had been able to effect, were being regularly received from such authorities throughout the country; whether he was able to state that substantial economies had been or were being made by such authorities; and whether he could take steps to make the information contained in the above-mentioned reports available to the local authorities in order to assist them in making savings. In reply, Mr. Long stated that a great many reports had been received showing savings which local authorities had been able to effect. Some of these were substantial and involved a material reduction of rates. The reports were not usually in a form which would be of much assistance to other local authorities in their consideration of economies, and his own view was that the best results were obtained by careful study of details in connection with the particular circumstances of each authority. He had, however, taken steps to give publicity through the Press to any information received which seemed likely to be useful to local authorities in general.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not rather to be regretted that the Institute of Sanitary Engineers at their opening sessional meeting on Wednesday evening did not follow the lead of other societies and forego all festivities during this crisis instead of having a conversazione with music and singing? While deprecating any pessimism or gloom at the present juncture, would it not have been better for this institution either to have given up the usual festive opening meeting altogether, or to have simply held a meeting for the discussion of some paper which might have been useful to the community?

* * * *

Is it not very interesting to observe that, as a result of the American experiments upon the effect of varying the percentage of water in concrete [*vide* THE SURVEYOR of the 24th ult.], the best results were obtained with the proportion of 27½ per cent [by weight] of water, but that in process of time a drier concrete gained in strength, though not equal to the 27½ per cent concrete? Should not the report of these experiments be carefully read and digested by every engineer who has to deal with concrete structures?

* * * *

What will be the effect of the war, if it continues much longer, on the livelihood of the consulting engineer where he is dependent upon municipal authorities as his clients? Have the Institution of Civil Engineers, or the Association of Consulting Engineers, done anything towards a solution of this problem since the outbreak of war? If they *have* done anything, should it not be made public in some way?

* * * *

Would it not be well to take a lesson from our enemies the Germans with regard to Imperial and municipal economy in our parks and public pleasure grounds? Is it a fact that they have turned these ornamental but otherwise unproductive acres into agricultural land on which vegetables and other food products are grown for the benefit of the community? What is the use of preaching economy when we see, on all sides, these large areas of land covered with well-kept lawns and expensive shrubs and flowers? Could not the labour and money expended on them be more usefully employed in other directions?

* * * *

Has anyone yet arrived at anything like a reliable figure in regard to the amount of water to be deducted from a gathering ground owing to evaporation and percolation? When it is considered that the sun is the chief cause of evaporation, that the days and hours in which the sun is obscured vary considerably year by year, and that the effects of wind are equally uncertain, can it be wondered that in every locality the amount of evaporation must be more or less an uncertain quantity? Is it not almost equally difficult correctly to estimate the amount of loss by percolation over a large area of barren land, which may contain undiscoverable fissures and porous places, and be subjected to changes due to temperature and other causes?

* * * *

Why is it that there are still districts in which the tar-painting of roads seems to be unpopular on account of alleged slipperiness? Why is it, for instance, that in Carmarthenshire there should recently have been made on the county council certain claims for damages resulting from a process which is so universally adopted in other counties? Is the climate of Carmarthenshire so different as to cause this slipperiness, or is it that wrong materials or methods are employed?

* * * *

Apropos of the above paragraph, cannot Mr. Boulnois introduce in his next "Glossary of Road Terms" a shorter and more euphonious word than "slipperiness"? Is there any word in the English language which will express this unfavourable quality in a shorter and better manner?

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—The rapid increase of sand wastes around our coasts is indeed a serious one, and Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

SOME RECENT PUBLICATIONS.*

FIVE FIGURE MATHEMATICAL TABLES. Compiled by E. Chappell, B.SC., ASSOC.M.INST.C.E. Price 5s. nett. London: W. & R. Chambers, Limited.

Modern science, and notably those branches dealing with electricity and thermo-dynamics, have rendered the old logarithmic tables inadequate for the purpose for which they were compiled. A fundamental difference between the new sciences and the old is, as the author of the volume under consideration points out, that, whereas in the old numbers had to be raised to simple powers only (merely squared in the majority of cases), fractional indices occur in all branches of the new. The defect of the old tables is that processes of involution and evolution are tedious with any but the simplest indices, whereas, by the use of tables adapted to the processes, modern calculations also can be reduced to the simplest form. Such tables, eminently adapted to modern use, Mr. Chappell has given us. They consist of logs and cologs of numbers from 1 to 40,000, illogs (antilogs) of numbers from ·0000 to ·9999, lologs (logs of logs) of numbers from 0·00100 to 1,000, and illologs (antilologs) of numbers from 0·0 to 0·5000, together with trigonometrical functions, and their logs of angles from 0 deg. to 90 deg. at intervals of one minute. Readers who are used to the tables of Napier and others will notice the new nomenclature adopted by the author, and will agree, when they have read the interesting preface to the volume, that the expressions adopted by him are better and certainly less cumbersome than the old ones. The volume is excellently printed, and the tables are well arranged and set in good, clear type.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. W. H. MATTHEWS JONES, City Engineer and Surveyor, Chester.

COUNCIL MEETING.

At a meeting of the council of the Institution of Municipal Engineers held in London on September 29th the following applicants were recommended for admission:—

To Membership: Messrs. A. H. Owen, A.R.I.B.A., H.M. Office of Works; M. E. Leslie, town engineer, Queenstown, South Africa; and C. B. Machin, sanitary surveyor, Alcester Rural District Council.

To Associate Membership: Mr. C. R. Brown, assistant surveyor, Wombwell Urban District Council.

ANNUAL MEETING.—It was decided that the annual meeting should be held in London in November, on a day to be arranged by the president-elect. Members willing to submit a paper for presentation to the meeting are requested to write to the secretary without delay.

THE LATE MR. W. R. BAILEY.—A vote of condolence with Mr. John Bailey (surveyor to the Spalding Urban District Council and member of the council) and his wife, in the loss of their son, Mr. W. R. Bailey (surveyor to the Holbeach Urban District Council and a member of the institution), who was killed at the front on August 12th, was passed. The council further expressed, on behalf of the institution, their keen regret at the loss of such a valuable and energetic member as Mr. W. R. Bailey.

PRESENTATION TO MR. H. BOOT.—A silver salver bearing the following inscription, was presented to Mr. H. Boot: "Presented to Horace Boot, Esq., past-president of the Institution of Municipal Engineers, by the members of the council and of the Southern District, on the occasion of his marriage, July 21, 1915."

B. WYAND,
Secretary.

The next meeting of the council will be held in London on Wednesday, October 27th.

The financial year 1914-15 ended on June 30th, and members who have not paid that year's subscription are requested to remit without delay. The subscription for 1915-16 fell due on July 1st.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

GAS MANAGER. — October 11th. — Llandudno Urban District Council. £160—£200. — Mr. A. Conolly, clerk.

MOTOR FIRE ENGINE DRIVER.—October 11th.—Corporation of Ossett. 30s. per week, with house, coal and gas.—Mr. T. W. Wilson, town clerk.

GENERAL FOREMAN.—October 11th.—Corporation of King's Lynn. 35s. per week.—Mr. A. J. Smith, borough surveyor, Town Hall.

STEAM ROLLER DRIVER.—October 11th.—Chertsey Rural District Council. 35s. per week.—Mr. C. G. Atkinson, engineer and surveyor, Station-road, West Byfleet.

SEWAGE WORKS FOREMAN.—October 15th.—West Kent Main Sewerage Board. £2 per week, with house, light and fuel.—Mr. A. B. Coomber, secretary, Park House, Bromley, Kent.

ASSISTANT ENGINEER.—October 22nd.—Water Department, Corporation of Sheffield. £300 per annum. Mr. William Terrey, general manager, Town Hall, Sheffield.

ASSISTANT ENGINEER.—Southern Command, Salisbury. £2 10s. per week. Also linesman jointer (£2 10s.), fitter drivers (£2 10s.), fitters (£2), engine drivers (£1 10s.), and switchboard attendant (£1 5s.). Chief Engineer, Southern Command, Salisbury.

ENGINEERS.—The War Department require district electrical and mechanical engineers in connection with the military hutment camps electricity supply. £3 5s. to £4 per week.—Chief Engineer, Southern Command, Salisbury.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

YORK. — November 30th.—Schemes under the Housing and Town Planning Act, 1909, in connection with certain areas within and without the city of York, for the corporation. Premiums, £100, £50 and £25.—Mr. F. W. Spurr, city engineer, Guildhall, York.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

BRADFORD.—October 12th.—For the erection of a waste warehouse, garage, and alterations to a mill, for the corporation.—City Architect, Town Hall, Bradford.

TOTNES.—October 14th.—For building a flushing tank and laying sewer, for the rural district council. Mr. W. F. Tollit, surveyor.

PRESTATYN.—October 14th.—For the erection of a retort-house and retort bench, for the urban district council.—Mr. L. G. Hall, gas engineer, Paradise-street, Rhyl.

EDMONTON.—November 9th.—For the erection of a cleansing station, for the urban district council.—Mr. Cuthbert Brown, engineer.

KILKENNY.—November 30th.—For the construction of a reinforced-concrete bridge, for the Kilkenny and Wexford County Council.—Mr. A. M. Burden, county surveyor, Kilkenny.

Engineering: Iron and Steel.

BELFAST.—October 13th.—For (1) the supply of a new or second-hand bucket ladder hopper dredger, (2) for the hire of a dredger, and (3) for dredging the harbour, for the Harbour Commissioners.—Mr. T. S. Gilbert, harbour engineer.

SHEFFIELD. October 14th.—For the supply of ironmongery for general repairs, for the Education Committee.—Mr. G. S. Baxter, secretary, Education Offices.

MALDON.—October 18th.—For providing and laying cast-iron water main, for the corporation.—Mr. T. R. Swales, borough engineer.

LITTLEBOROUGH.—October 22nd.—For supplying and laying electric cables and other works, for the urban district council.—Mr. G. H. Wild, clerk.

NEYLAND.—October 23rd.—For the supply of 600 yards of wrought-iron fencing, for the urban district council. The Surveyor.

Roads.

WARRINGTON.—October 11th.—For the supply of 600 lin. yds. of dressed kerbs, for the corporation. —Borough Surveyor.

PETWORTH.—October 11th.—For steam rolling and scarifying, for the rural district council.—Mr. E. H. Staffurth, clerk.

FELTHAM.—October 13th.—For the supply of granite, for the urban district council.—Mr. G. Stevens, surveyor.

BATTLE.—October 14th.—For the haulage of 400 tons of broken stone, for the rural district council.—Mr. H. Blackman, surveyor, Catsfield, Battle.

SHEERNESS.—October 19th.—For the supply of basalt or broken granite, Kentish ragstone, and clean, dry hoggin, for the urban district council.—Mr. T. F. Berry, surveyor.

ROMFORD.—October 25th.—For the supply of granite, for the rural district council.—The Highway Surveyor.

BEDLINGTON.—For the supply of 5,000 tons of hand-broken road whinstone, for the urban district council.—Mr. J. E. Johnston, surveyor.

Sanitary.

WIGAN.—October 11th.—For the supply of 500 galvanised sanitary pans, for the corporation.—Mr. W. H. Tyrer, town clerk.

BLAYDON.—October 12th.—For the removal of contents of ashpits, for the urban district council.—Mr. R. Biggins, Council Offices, Blaydon-on-Tyne.

KINGSTON-ON-THAMES.—October 13th.—For the supply of 4,000 yds. of press cloth and 300 tons of 80 per cent sulphuric acid, for the corporation.—Mr. R. H. Clucas, borough surveyor.

MARYLEBONE.—October 22nd.—For the removal of house refuse, for the borough council.—Mr. J. Wilson, town clerk.

SUTTON - IN - ASHFIELD. — October 30th. — For alterations to existing sewage tanks, the construction of new screening chamber, settling tanks, rectangular bacteria beds, humus tank, engine-houses, office, and other incidental works, for the urban district council. —Messrs. Willcox & Raikes, 63 Temple-row, Birmingham.

Miscellaneous.

BOSMERE AND CLAYDON.—October 14th.—For sinking a well, for the rural district council.—Mr. R. M. Cook, clerk, 20 Providence-street, Ipswich.

TREDEGAR.—October 18th.—For concreting and masonry, supplying cast-iron pipes and pig lead, and excavating trenches for waterworks, for the urban district council.—Mr. W. E. Jones, engineer, 1 Commercial-street, Tredegar.

GUILDFORD.—October 19th.—For the removal of an old bridge and the construction of a new bridge, for the rural district council.—Mr. J. Anstee, engineer, Council Offices, Commercial-road, Guildford.

Institution of Mechanical Engineers.—The Thomas Hawksley Lecture on "The World's Sources of Fuel and Motive Power," by Dr. Dugald Clerk, F.R.S., member of council, will be delivered in the meeting hall of the Institution of Civil Engineers, Great George-street, Westminster, S.W., on Friday, October 29th, at 8 p.m.

The Lilian Bradshaw Fund.—The British, Foreign and Colonial Automatic Light Controlling Company, Limited, 100 and 102 Holdenhurst-road, Bournemouth, write: "We have very much pleasure in enclosing you a cheque for £10 on behalf of Mrs. Bradshaw, the widow of the late surveyor of Tamworth, and we trust your appeal on her behalf has met with a ready response." This generous contribution brings the total of the fund up to £26 9s.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. OCTOBER 15, 1915. No. 1,239.

Minutes of Proceedings.

The Action of Water Under Dams.

The study of all matters relating to the stability of dams has a peculiar fascination for those who are responsible for their design and construction. The greater the knowledge and experience of the student, the more fully will he grasp his ignorance of the many facts which have a bearing upon this particular problem. It is not suggested that the engineer is unable to construct dams of unquestionable safety and stability, but that the underlying principles in their entirety have yet to be fully discovered and proved. It is not practically possible to prove theories by testing large dams to destruction by trial and error under all the possible conditions which may occur in practice, and our knowledge has to a certain extent been gained by experiments carried out with models.

Excellent work of this character is described in a paper published in the "Proceedings" of the American Society of Civil Engineers, entitled "The Action of Water Under Dams." The paper was presented last month by Mr. J. B. T. Coleman; it gives the results of a careful study of the action of water under dams made by the author in connection with his graduate work at the University of Michigan. This experimental work was carried out in order to investigate the relation existing between the height of water on the face of a dam, the length of the base of a dam measured perpendicular to the face, the distribution and upward pressure on the base of the structure, and the effect of sheet piling at the heel and toe of the dam. Careful observations were taken by means of a model and special apparatus, and the results are tabulated very fully, while they are also illustrated by a large number of diagrams showing graphically the water pressures at different points under the dam. The information given is very complete, and evidently the result of much painstaking work, and is a valuable contribution to the study of the subject. Conclusions derived from experiments of this kind have a limited application, but they are none the less valuable if rightly regarded, and the experiments in question go far to prove certain facts of great interest which ought to be taken into account carefully.

The author's conclusions are to the effect that the loss of pressure head of water passing from above to below a dam may be divided into three stages: (*a*) A relatively large loss of head, occurring where the water enters the sand; (*b*) a uniform and comparatively small loss of head per foot of length through the body of the sand; (*c*) a larger loss of head where the water leaves the sand. It should be observed that in the experiment the dam rested on sand, and that the water passed through this sand under the dam and out at the back or heel of the dam. It was found that under these conditions the first stage of entrance loss is increased as the length of the flow is decreased; that the rate of flow decreases very rapidly with the depth below the floor of the structure, being more concentrated for shorter flows; that the flow lines, once established in a porous medium, tend to continue horizontally as such, and come to the surface only after travelling a relatively short distance; that the porosity, effective size and uniformity co-efficient have little influence on the upward pressure exerted against the flow of a dam. The author seems also to have proved his points that piling at the heel of a dam reduces the pressure on the flow, and that piling at the toe increases it. Piling at the heel of a dam to be effective must be tight, as a very small leakage will destroy its action. On the other hand, piling at the toe of a dam should be loose, in order to prevent increasing the upward pressure in the flow of the structure. It therefore follows that an impervious cut-off wall of comparatively shallow depth—say 5 ft.—at the heel of the structure will greatly increase its stability by reducing the upward pressure on the floor. The experiments and their results become doubly important if we accept the conclusion that the quality of the material upon which the dam rests has little influence upon the water pressure exerted against the underside of the foundation. Obviously, if the material under the foundation were absolutely watertight, no upward water pressure could exist, but with this exception it seems reasonable to suppose that the author's conclusion is right, and that the facts recorded have a wide application.

* * *

Public Health in Essex.

The annual report of Dr. Thresh, the county medical officer of health for Essex, shows in the first place that, although many medical officers of health in the county undertook military duties on the outbreak of war, the officials who were left were highly successful in dealing with the situation brought about by the quartering of enormous numbers of soldiers in the towns and villages. This sudden increase in the population led to many sanitary complications, but on the whole the effect was marvellously small. The medical officers of health, sanitary inspectors, and sanitary authorities rose to the occasion. Scavengers were appointed in many villages, an increased number of scavengers appointed in

towns, water supplies improved and increased, numerous analyses made, pavilions added to the isolation hospitals at Colchester, Chelmsford, Harwich, and Orsett, and billets systematically inspected. The sanitary and other medical officers attached to the troops put themselves in communication with the local medical officers of health and with the county medical officers, and by co-operation it was possible to cope with all the difficulties which arose. The satisfactory result has been that during the year there was no unusual prevalence of infectious disease and no appreciable effect upon the mortality. The health of the troops and of the civil population has been excellent, and is proof of the efficiency of the sanitary administration.

Of the ordinary matters mentioned in the report, reference may perhaps be made to the subjects of water supply and closet accommodation, both of which are dealt with rather fully. In regard to the water supply of the urban districts, Dr. Thresh is able to say that, speaking generally, this is sufficient for all immediate requirements, the water being of excellent quality; but, he adds, if the population continues to increase difficulties will arise in certain portions of the county, and in order that the situation may be faced he advocates legislation on the lines proposed in the recent Local Government Board return, by which the county council or a rivers board would have to take immediate steps to ascertain the amount of available water in all parts of the county and to decide how the whole could best be utilised in the interests of all concerned. In the rural districts, too, the water supply is said to be generally satisfactory—but only by comparison with other counties, and many areas where improved supplies are urgently needed are mentioned. In dealing with closet accommodation, Dr. Thresh rightly condemns the fixed privy, pointing out that they may be of various types, all objectionable, and differing only in their degree of objectionableness. The worst is the one with an immense subterranean vault which only requires emptying at long intervals, the least objectionable is one with a small receptacle, watertight, and above ground, which must be emptied at frequent intervals. The latter if used with dry ashes or earth is as satisfactory as any privy-can be, but is not so sanitary as a pail-closet similarly used. In urban districts there should be no privies of any kind in the populous area, but in the thinly-populated area beyond the limit of the sewers there must be either privies or pail-closets. Nevertheless, these abominations still exist in considerable numbers in many of the larger towns in Essex, and Dr. Thresh is undoubtedly right when he says that it is desirable that more energetic steps should be taken to get such insanitary arrangements abolished.

* * *

Municipal Architecture in Manchester.

The question of the open door in municipal architecture, which has been raised more than once elsewhere, has been under the consideration of a special committee of the Manchester Corporation recently. Some members of the Manchester Society of Architects had an interview with the committee, during which they enlarged upon their plea that much of the municipal architectural work now done by the city architect, Mr. Henry Price, might advantageously be done by practising architects. It was in the highest interests of the community, it was argued, that opportunity should be given to the city council for the best architectural services to be available for the designing of public buildings, and this could be best attained by skilled and independent thought being brought to bear on all new building problems. This contention, which most people would regard as indisputable, was supplemented by the declaration of the spokesman, Mr. Gass, vice-president of the Manchester Society of Architects, that in asking for favourable consideration of the subject the deputation made it clear that nothing of a personal nature was intended. In an advisory and consultative capacity, Mr. Price's services, they said, had been much valued, and were appreciated by the deputation. Upon the economic aspect of the matter it was urged definitely that there would be some saving if the plan advocated were carried out.

As to this, Mr. Price, in his report upon the points raised, was at issue with the deputation. He does not admit—to quote a specific instance—that the cost of schools erected under the supervision of independent architects was less in comparison with the cost of schools built under the direct control of corporation officials; and as to general costs, he submits that no saving would accrue to the corporation by the abolition of his department, for architects' fees and commissions on the volume of work would be quite equal to the cost of the corporate department. The question of cost, important though it is, may be over-emphasised in such a discussion as this. Obviously it ought not to weigh in the balance against the system, whichever this may be, which gives the best results from the point of view of public architecture. It appears that more will be heard about the matter, and rightly so, as the committee intend to invite the several spending committees of the corporation to state their views. This will open up an interesting and, it is to be hoped, fruitful field of discussion upon a subject of the highest importance.

* * *

Municipal "Push and Co."

For some time past it has been the practice of the municipal authorities of seaside resorts, spas, and "watering places" to spend money and energy in advertising and pushing the advantages of their respective towns. The Nottingham City Council, however, have made a somewhat new departure by passing a resolution to appoint, at a salary of not exceeding £250, an officer whose duty it shall be to develop the industrial resources of this already progressive commercial city. These duties apparently will be to organise a systematic effort to secure the establishment of new commercial enterprises in Nottingham, pointing out the advantages that it offers to such enterprise, to collect data as to new industries in all parts of the country by consulting trade newspapers, so that as occasion arises the advantages of Nottingham may be placed in the proper quarter, and generally to push the claims of Nottingham as a good and convenient business centre.

We believe that other towns in the country have made similar efforts, but with what success, or whether they have been on the same lines as those of Nottingham, we do not know. There can be no doubt that in this age of stress and competition it is no use "sitting down" and expecting business to come in, and if Nottingham is able to secure the right man it should be the means of making the city grow commercially even more rapidly than it has done in the past—if that were possible. There is a well-known American adage which says: "Early to bed and early to rise is not a blank bit of use unless you advertise," and there is a considerable amount of truth in these words. The only question for the Corporation of Nottingham to consider is whether they will get a real man of "push and go" for the modest salary of £250 a year. There may be, of course, a large number of real "live" men who would be capable of conducting such an undertaking in the ordinary way, but will Nottingham be able to secure another "Calisthenes" of Selfridge fame for the money?

Engineering and Idealism. An address of rather a novel character was delivered last month by Mr. Charles Marx, the newly elected president of the American Society of Civil Engineers, to the annual convention of that body at San Francisco. Mr. Marx took as his subject "The Engineer as Idealist," and by an able review of the various fields of engineering practice he showed that engineering and idealism are not of necessity incompatible. In speaking first of sanitary engineering, he made eloquent reference to the close connection which exists between sanitary engineering practice, preventive medicine, and the realisation of the social ideal. For example, although the demolition of insanitary cottages in rural districts often involves the destruction of the purely picturesque, it must not be forgotten that the picturesque is often merely a cloak for squalor, dirt, misery, and sickness. Who, then, asks Mr. Marx, is the idealist? The man probing into the sore which has so little surface indication, finding its deep-rooted seat and skilfully using the knife, or the man who, misled by these same facts, applies a surface dressing and allows the sore to eat into the body? Reference was also made to the function of irrigation in opening new territory, to the unifying influence of railways, and the romance of bridge building, and in illustration of the fact that the great engineer is always animated by a great ideal, Mr. Marx quoted the words of Captain Eads uttered on the occasion of his undertaking his great work on the Mississippi: "I undertake the work with a faith based upon the ever constant ordinances of God Himself; and so certainly as He will spare my life and faculties for two years more, I will give to the Mississippi, through His grace and by the application of His laws, a deep, open, safe, and permanent outlet to the seas."

* * *

Sanitary Progress in Peru and Bolivia. In another column will be found an interesting article extracted from the current issue of the Journal of the Royal Sanitary Institute, in which Mr. H. J. Bingham Powell, M.INST.C.E., late engineer to the principal municipalities and Government of Peru, and to the Bolivian Government, traces the progress which has been made in those countries in recent years in the matter of sanitary reform. The urgency of the question was first recognised in 1903, when there was a serious outbreak of bubonic plague at Callao, the principal port of Peru. Tuberculosis, too, has been rife in the principal towns, a fact that is to be attributed to the inferior mode of living and the unhealthy homes of the lower classes. In recent years, however, there has been considerable improvement, not only by the execution of works of sewerage and water supply, but also owing to the interest taken in sanitary matters by educated people, the beneficial effects of legislation, and the advantageous results of a propaganda instituted by the newspapers and other public organs. A good example of the work done is afforded by the sewerage of Lima, which was put down some fifty years ago, and is of the defective design current at that period. Now, nearly all the bad sewers have been replaced by stoneware pipes, with great advantage to the town, the population of which is not far short of 150,000. Mr. Bingham Powell's article, which is full of interest, supplies many other examples of good work done.

* * *

Road Warnings. In these days of high-speed traffic it is very desirable that danger and direction signs, which are erected not only for the convenience of motorists, but also for the protection of the public, should be uniform in character and appearance. Moreover, if such signals are to be of maximum utility, the sites upon which they are to be erected ought not to be left entirely to the discretion of the highway surveyors, whose ideas as to what constitutes a danger point may differ very widely. It is a good general rule that every sign erected must be really necessary for the welfare of the road user, for the erection of unnecessary signs merely discounts the value of warnings that are essential to the safety of the public; and herein lies the value of the work that is being done by the Automobile Association and Motor Union in this direction. The association supplies its special signs without charge, but only for places where they are considered necessary for the safeguarding of what would otherwise be unsuspected danger. For instance, where a cross road or road junction is out of view, but a direction sign is visible, there is no necessity for any further indication. In the same way there is no need for a dangerous corner sign where an indication of the radius or angle of the corner can be obtained from the contour of the road, unless the available width for vehicles diminishes, or the radius becomes less than is apparent. The utility of some central guidance in these matters is evident, and surveyors are usually able to agree with the suggestions put before them by the association regarding the erection of additional signs and the removal of redundant or unnecessary road warnings.

* * *

The Institution's Orphan Fund. Mr. O. Claude Robson, M.INST.C.E., the hon. secretary and hon. treasurer of the Institution of Municipal and County Engineers' Orphan Fund, is good enough to send us, by arrangement, a reminder when our annual donation is due, and we venture to quote the well-chosen terms of his appeal. "I am extremely sorry," he says, "to trouble you at this period of stress in connection with any matter of subscription, but the needs of the Orphan Fund of the institution are now so urgent, owing to new cases before the committee and to the fact that even more may arise owing to so many of our members being with his Majesty's Forces, that it is most important the funds should be kept up to as generous a level as possible. May I therefore urgently request you to let me have your subscription so kindly accorded in previous years, as with any reduction in our list of subscribers I am much afraid some difficulty will ensue in connection with extension of grants?" We have every confidence that others who receive such a reminder will deal with it as we have, promptly and ungrudgingly, feeling that, unless necessity is dire, the Orphan Fund should be the very last to suffer on the altar of economies; but we give publicity to Mr. Robson's letter in the hope that it may catch the eyes and appeal to the pockets of some of the very many who are not already regular, or even occasional, donors to this most deserving of causes.

A Conway Improvement.—The approach to the road leading to the Town Mountain through Cadnant Park, Conway, has been widened, and at the last meeting of the town council Mr. Robert Jones asked by whose authority the work was done, inasmuch as the council had declined to carry out the work. The mayor, Mr. E. Jones, said that at the outset the council were asked to pay half the cost of the widening, and though they refused to do this they were in sympathy with the improvement. Councillor J. Stott took the matter in his own hands and had it done. It was quite as well to allow the matter to lie there. Mr. T. H. Edwards asked what the attitude of the borough surveyor would be if some other individual did similar work in another part of the town. The borough surveyor, Mr. F. A. Delamotte, said there was nothing to stop a man from setting back his boundary wall and making the public road wider. If he did anything to obstruct the highway it would be another story.

C

Housing in the Hemel Hempstead Rural District.

A KINGS LANGLEY SCHEME.

The accompanying plans and photographs illustrate a housing scheme carried out by the Hemel Hempstead Rural District Council at Kings Langley, Hertfordshire, where the lack of cottages has been very acute.

The scheme was prepared by the council's surveyor, Mr. Thos. H. Lighbody, M.S.A., and the work was carried out by Mr. Thos. Higgs, of Northampton, under the supervision of the surveyor, without the assistance of a clerk of the works.

There are fourteen cottages in all, two end blocks of four each, and one central block of six with a central passage running through. The area covered by the scheme is nine-tenths of an acre, great difficulty being experienced in obtaining suitable land, and although the piece ultimately procured is an excellent site, it is, unfortunately, on the small side.

The type of dwelling is on the small villa lines of planning, having a parlour and small hall. There is an absence of unnecessary and expensive detail, but both the front and rear elevations have a pleasing effect to the eye and are in strict harmony with the surroundings.

Front and Rear Views of Kings Langley Cottages.

In each entrance hall the staircase is not boxed in, except to form a small cupboard for the gas meter just under the bottom "winders"; the space thus obtained gives ample room to stand a cycle or a perambulator if so desired. The hall is lighted by stained glass panels in the door and a small window at the bottom of the stairs. From the hall are two doors, one into the parlour and one, which is half-glazed, into the living-room. The prospective tenants' requirements demanded a parlour, and the rent charged for the cottages warrants the extra outlay. The parlour is fitted with a tile register grate and hearth to match.

The living-room was purposely designed as large as possible, and the window to this room is also of ample size. Genuine "Larbert" ranges are provided, and a good cupboard and dresser is placed across one end of the room. Picture rails are provided in the living-room, parlour and hall. Gas is carried to four points.

The scullery is just a comfortable width. There is a copper of the "Ideal" type provided in the internal angle near the living-room door; space under the hinged flap is left for a gas stove and bath. The baths are enamelled iron, with tops to form a table when not in use. The waste is fitted with an elbow, screwed 1-in. brass, and a short length of hose, with a union attached, is provided for emptying it, a 2-in. diameter piece of iron pipe being built in the external wall leading to the channel of the sink gully outside. This arrangement answers well; there is no fixed waste or internal gullies, and thus the bath can be picked up and removed at any time without trouble. Opposite the bath is a food store, and all the sculleries having a southern aspect have the small window, shown on the drawing, fixed inside the lobby, and thus missing the direct rays of the sun. The sinks are glazed caneware, and grooved draining boards are fixed. A small observation window is put in between the scullery and the living-room. This has been a source of some difficulty, owing to the bath being unscreened, but the tenants soon fixed up small blinds. The real object of these windows is to borrow the gas light from the living-room pendant and to allow a person to work in the scullery with a closed door without losing sight of children who may be left in the other room.

The external scullery door opens into a lobby, with coal-house and water-closet all under cover.

The rooms on the first floor call for no special comment. They are light and lofty, being well ventilated, and in each are additional means of ventilation by ceiling panels and air bricks. A good cupboard is provided in the largest bedroom.

As regards the construction of the cottages, there is no great departure from the usual specification for such work. It will be noticed that all walls subject to driving rain are constructed with a cavity; the bricks are hard stocks, relieved with red arches and bands.

The roofs are slated, having a 40-deg. pitch. Hemel Hempstead patent bricks are used for partitions where possible on the first floor, and "Semicostic" tiles are used in the scullery, back lobby and water-closet. The whole of the internal woodwork has been treated with two coats of Major's Solignum, well sized and varnished, and the front doors are treated with Blundell Spence's maroon petrifying liquid—all with very gratifying results.

The existing front hedge was retained, being well cut down and "laid," and the remaining three sides of the plot of land is fenced round with a 5-ft. deal close-boarded fence. There is also between the backs of each cottage a 6-ft. close-boarded fence to act as a screen. Each cottage has about 19 super. yds. of tar-paving at the rear, the customary galvanised-iron ash-bin, and two steel clothes posts made from old boiler tubes, drilled one end, and with cross-pieces of ½-in. iron tube driven through.

A few details as to cost, &c., are appended.

Fourteen Cottages.

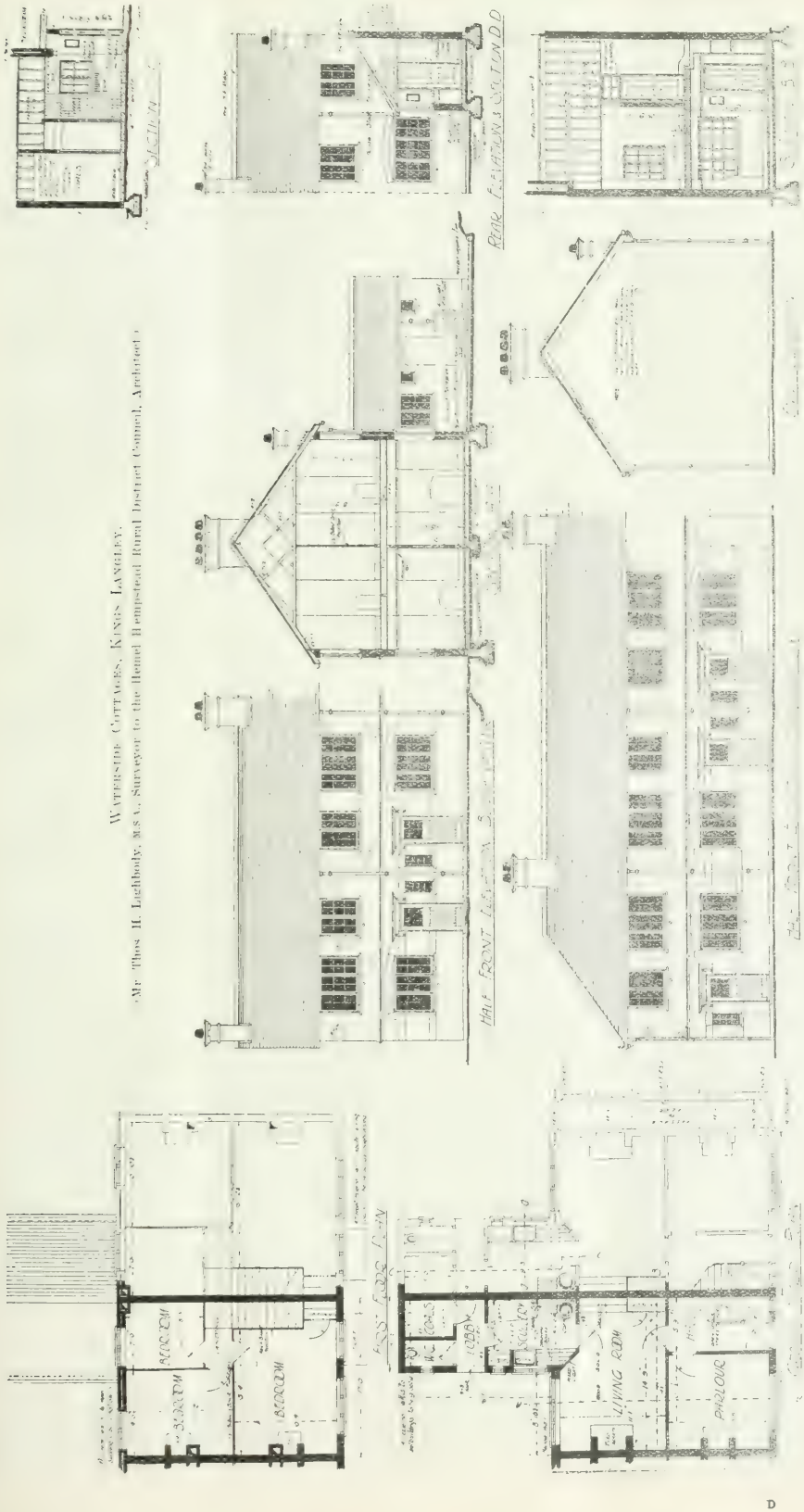
	£	s.	d
Contractor's original tender (June, 1914)	3,118	0	0
Contractor's amended tender owing to war	3,239	0	0
Cost of land (⅞ acre) 30s. foot frontage	388	10	0
Actual cost of building	3,264*	0	0
Cost of cottage and land ... each	261	0	0

Rents of cottages, 13 at 7s. 2d., and 1 at 7s. 8d. per week.

* £25 increase includes cost of baths not provided for in amended tender.

The odd twopence represents the extra charge of the water company for water for the bath. All tenants requested baths, and gladly pay the extra charge.

In conclusion, it is as well to add that not the slightest difficulty has been experienced in letting the cottages; dozens of persons were turned away, while there is a long waiting list for the first cottage vacant.



WYTHERSTONE COTTAGES, KINGS LANGLEY.

Mr Thos H. Lightbody, M.S.A., Surveyor to the Hemel Hempstead Rural District Council, Architect.

Rural Highways*.

By ARTHUR GLADWELL, Engineer and Surveyor to the Eton Rural District Council.

"The road is as necessary an instrument of social well-being that in every new colony it is one of the first things thought of."
—SMILES' "Lives of the Engineers," Vol. I.

"There are many standards by which the progress of civilisation can be judged. . . . But there is no better criterion of a nation's progress, its organisation and efficiency, its commercial and social life, than the quality of the roads it possesses."
—LORD MONTAGU OF BEAULIEU.

One of the difficulties which beset the path of any writer on a subject such as the one under review, when the result of his efforts have to be submitted to an international audience, is that of nomenclature—how best to express in understandable language what he wishes to convey; another difficulty is that, however experienced, well-read and travelled he may be, he cannot hope to be on speaking terms with all that is useful and necessary to be known concerning the practice connected with his subject all over the world, but must, almost inevitably, take refuge behind his somewhat insular knowledge of practice and performance as it obtains in the country of his birth or adoption. In dealing with a topic such as the construction and maintenance of roads, this is peculiarly so. It therefore almost necessarily follows that this paper, however "international" the author may try to make and keep it, will more or less reflect English practice in present-day road construction and maintenance.

It is not the author's intention to attempt to argue what is or ought to be understood by the term "rural" as applied to highways; the word may have the same meaning all over the world, with a more or less extended application. In this country there are rural "main" roads and rural "district" roads, the status of each depending on the fact as to whether they are maintained by county or rural highway authorities.

But, whatever the term may mean in its application to road work, it is certain that the term "rural highways" comprehends almost every type of road, with the probable exception of granite-pitched, wood-paved, or sheet-asphalt roads, and even these classes of roads are to be found in rural districts near London and other of the more important English cities.

It will thus be realised that the title of the paper is fairly comprehensive.

It is common ground that until the advent of the automobile in its varying forms and adaptations, by far the greater area of rural highways were constructed and maintained under the water-bind system, the only variant being the character of the aggregate used. This, of course, depended very largely on the traffic intensity, as well as upon availability of material, and therefore upon initial cost.

FOUNDATIONS.

The lack of proper or adequate foundation structure, which is one of the outstanding features of most rural highways, presents an important initial difficulty, and one which (in view of the increased traffic strain all roads are now subjected to by reason of the rapid and increasing growth of mechanically propelled traffic) will become from year to year more important, and at the same time less easy of solution.

It is almost a stock phrase that one cannot be expected satisfactorily to maintain a road unless such road has a good foundation; yet practical road engineers have to get along as best they can in this connection by maintaining year after year, in good condition, roads the chief characteristic of which is the lack of the very foundation which is said to be indispensable to their satisfactory maintenance.

The practical road engineer realises that it is economically impossible to refound even a small proportion of the badly founded roads which already exist, and that he must take them for what they are and make the best of them. It is in this connection that there exists a large field for the exercise of the ingenuity of the highwayman in producing on, and in connection with, the surface of an existing road an element of strength which shall, in some measure at all events, take the place of the foundation which ought to be there, but which never was there.

The necessity for a thorough remodelling of method in road repair and maintenance which may be said to be the outcome of the revolution in user to which roads are being subjected, has given birth to many ideas, and resuscitation to others; but the consensus of practical opinion appears to point to bituminous products of various kinds as forming a range of available material readily applicable as a binder or flux for use in conjunction with ordinary road stone as the aggregate.

* From a paper read at the International Engineering Congress, San Francisco.

BITUMINOUS CONSTRUCTION.

There can be little doubt that a properly prepared tar or bituminised macadam forms one of the best, most practical, and ultimately economical preparations for road surfacing work; one of the difficulties, however, attending the use of this material is that if the tar compound with which the aggregate is coated is sufficiently distilled and dehydrated, and otherwise properly prepared for road work, the mixing thereof with the stone aggregate must be carried out at the time it is required for use, and preferably in situ, owing to the fact that a properly prepared tar compound, especially if in its composition material of an asphaltic nature is introduced, sets off quickly, and possessing, as it does, only one setting moment, it is incapable of being kept or stored for an appreciable period after incorporation with the stone aggregate, and must be applied to the road soon after its manufacture.

But while the author is satisfied that bituminous-bound roads are superior in every respect to those constructed under the water-bound system, he is also satisfied that economy—not only initial, but ultimate—could and would be effected by a more modest use of materials. It seems such a waste of good material and labour to resurface a road to a depth of 5 in. or 6 in. (12½ to 15 cms.), when an equally good result could be obtained by the application of a surface coat of 2½ in. (6¼ cm.) in thickness. It does not appear to be sufficiently realised by road engineers that (assuming a reasonably good foundation exists, thus providing for the dead-weight resistance of the traffic to which the road is subjected) the wearing surface need not be of great thickness, and indeed need be but a thin one, always assuming that it is composed of properly selected and prepared materials suitably and intelligently applied.

It has been said that one of the functions of a civil engineer is that of being able to do for a penny what any fool could do for twopence; and if this comparative statement could be said to apply to the civil engineer in general, it could most certainly be said to have a special application to the work of the road engineer, since it is so very easy to throw away good money on poor materials and unskilful work in the practice of road maintenance.

The advent of the automobile has undoubtedly brought the road question in all its bearings into prominence, and has rendered the question of the construction, reconstruction, administration and maintenance of highways one of extreme importance in the economy of modern-day life, and it behoves all those engaged in the management of public highways to bring to bear on the subject all the powers of skill and sound judgment of which they are capable. There is still a great field for the exercise of skill and ingenuity, as well as of high administrative talent on the part of those engaged in the practice of highway engineering.

Road engineers have had in the past few years enormous difficulties to contend with; the great expansion of road traffic has not been accompanied by a correspondingly great expansion of financial means whereby roads could be prepared and fitted to bear such increased and increasing traffic, and the wonder is, not that so little has been done to meet the exigencies of the case, but that so much has been accomplished under circumstances of such difficulty.

The original idea of a paving material for roadways was a hard, rigid-wearing surface, the foundation under it being often considered as a secondary matter; experience has, however, now demonstrated that for heavy traffic a tough and slightly resilient surface material on an unyielding foundation is essential.

Of course, the above can only be regarded as a general principle, and must be considered in conjunction with other requisite qualities—such as impermeability, ease in cleansing and repairing, initial cost, &c., as well as local climatic conditions.

In considering the character of materials to be selected for road construction, it would appear that

the safety of the resultant road should be the first consideration, this [illegible] consideration of cost as can possibly be [illegible] at a time.

It is to be feared that in far too many instances the question of the safety of the travelling public is thought of far too little by those who have the selection of materials; thus we find in many cases hard, brittle, non-absorbent furnace slag coated with tar is used which wears to the smoothness of glass, and is cruelly dangerous in damp weather owing to the fact that the material formed by the wear of the road is in the form of a fine powder, which, when wet, forms a slimy, slippery mess upon which it is next to impossible for animals to retain a foothold, and which, on the recurrence of the slightest frost, presents a surface positively inimical to life and limb to essay to travel.

METHODS OF MACADAM AND TELFORD.

In the United Kingdom road making with broken stone will always be identified with James Loudoun Macadam, from whom this form of road construction received its name in England. The honour is somewhat unmerited, as the main principles of Macadam's construction are now largely discountenanced, and the methods of his contemporary Thomas Telford, "the father of English road making," are more generally followed. The differences between the methods of Telford and Macadam may, however, be briefly [illegible]:—

Macadam.

Foundation.—None.
Metalling.—Uniform coat, 11 in. thick, of stone broken to a 2-in. gauge.
Binding.—None.
Drainage.—Through cross drains, side channels and ditches; made his roads above level of surrounding country whenever possible.

Telford.

Foundation.—Hand-pitched rock, 7 in. deep, tops not to exceed 3 in. in width; interstices filled and consolidated with small stones, and levelled off to a cross contour of 1 in 60.
Metalling.—One coat, 7 in. deep, of broken stone, no stone exceeding 6 oz. in weight, and all passing through a 2½-in. ring.
Binding.—1 in. of gravel.
Drainage.—Nine stone cross drains to each mile length, delivering into side ditches; channels delivering into cross drain on each side.

The fame of Macadam and Telford as road makers was not due so much to original ideas on their part as to their adaptation of existing methods, combined with great administrative capacity. Thus, the broken-stone method was already in vogue on the Continent, and had been adopted by John Metcalfe, a predecessor of both Macadam and Telford. Tresaguet, the French engineer, was laying roads with hand-pitched rock some thirty years before Telford adopted the method, and it is curious to note that the engineers of the ponts et chaussées abandoned their own excellent idea for a while to take up the less-sound one of Macadam.

Macadam's theory that the elasticity afforded by the natural road bed was of advantage in giving the property of resiliency to the road bed, and that therefore no distinct or separate foundation was required, does not now seem to be accepted, while Telford's elaborate and expensive hand-pitched foundation is only followed, if at all, in road building for heavy traffic, or for the purpose of ensuring adequate under-drainage on clay or other heavy soils.

For the most part, where foundations are put in, they consist of hardcore, such as broken bricks, clinker, pottery refuse, &c., rolled, preferably in layers, to the required thickness and formation. The cross-sectional contour of the road surface should be reproduced in the foundation, care being taken to ensure that the shoulders of the road (in the absence of stone or other kerbs and channels) are built up of large material so as to form buttresses calculated to resist the lateral spread of the road material.

STEAM ROLLING.

Steam rolling has now become an integral part of the operation of both the construction and maintenance of roads, and few roads are now resurfaced or extensively repaired without its aid. The advantages to be derived from the use of steam rollers may be said to include (*a*) a saving of metalling as well as time, inasmuch as a thinner coat of metalling (being more effectively consolidated) will suffice than would be necessary if consolidation was effected by the traffic; (*b*) a smoother surface, affording easier traction, can be obtained; (*c*) the saving of material over the old method of traffic consolidation, as well as the avoidance of damage to vehicles; and (*d*) economy in binding materials.

The disadvantages of steam rolling are, (*a*) that very often a much too heavy roller is used, and rolling is carried beyond the effective point, resulting in loss of material by crushing action. Contrary to opinions often expressed to the effect that the crushing of road stone indicates that the stone itself is of poor quality, the author has found it possible to damage the best and toughest basalt or porphyritic granite considerably by rolling quite dry with even a 6-ton roller, and considers that an 8-ton roller is quite heavy enough for any but heavy town work, and that the use of a roller heavier than 10 tons does more harm than good on almost any class of work.

The question of the position and depth of sewers, drains, or gas and water pipes also has an important bearing on the question of the use of steam rollers, inasmuch as many hundreds of miles of these pipes were laid at an insufficient depth years before rollers were in common use, and although it is comparatively easy to require that all new pipes be laid so as to have at least 3 ft. of cover, the road engineer is, in numerous instances, still confronted with the difficulty of rolling over pipes which are laid at a less depth than 3 ft.

The number of times a roller must pass over a given point to secure effective consolidation varies, first, in proportion to the hardness of the stone; secondly, according to the thickness of the layer, but not in proportion to it; and thirdly, if the stone is dry.

Mr. Rockwell estimates that with a layer of 3 in. in thickness a 10-ton or 12-ton roller must pass over limestone fifty times, granite fifty to seventy-five times, porphyry ninety to one hundred times.

Watering should be resorted to in the early stages of consolidation, and is best applied by means of a spraying apparatus attached to the roller (so as to spray water on the wheels), which, besides economising the use of water, renders it possible to apply the required quantity, and no more, in an effective and perfectly controlled manner.

BINDING MATERIALS.

On no account should a binder of mud or old road scrapings be used to complete consolidation of the road-crust by filling the voids. If a bituminous binder is out of the question (the initial cost of such a binder is its only drawback, as its use is undeniably an ultimate economy), loamy sand, used either alone or in conjunction with granite dust or chippings, is the best binder. All binding agents should be used in correct relative quantities to the weight of stone to be consolidated, the quantity of binder being about one-fourth of the weight of the aggregate, or less if possible.

Mr. G. Tillson (U.S.A.) advocates fine limestone screenings, and considers trap rock screenings and sand in the proportion of 3 of screenings to 2 of sand gives good results. Trap and other igneous rock screenings have little cementition value, and if the binder is solely composed of these it will require a considerable amount of rolling.

Mr. Deacon, formerly city engineer, Liverpool, carried out some experiments bearing on this matter, the result of which is stated as follows:—

"Under a 15-ton steam roller, preceded by a watering-cart, 1,200 sq. yds. of trap-rock macadam, without binding, was only moderately consolidated by twenty-seven hours' continuous rolling. If trap-rock chippings are used, the same area may be moderately consolidated in eighteen hours. If siliceous gravel, from ¾ in. to the size of a pin's head, mixed with one-fourth part of macadam sweepings, obtained in wet weather, be used, the area may be thoroughly consolidated in nine hours. Macadam laid by the last method wears better than that laid by the second, and that laid by the second much better than that laid by the first."

Experiments conducted by Mr. W. H. Grant, superintending engineer of the New York Central Park, in the construction of his park roads demonstrates the necessity of using binding material.

Mr. Grant in these experiments followed Macadam's "no-binding" theory. The bottom layer of stone was, under a 12-ton steam roller, sufficiently consolidated to form and retain (after the compression had reached its practical limit) an even and regular surface, but it was found impracticable to solidify the top layer and reduce it to such a surface

as would prevent the stones from loosening and being displaced by the action of wheels and horses' feet. No amount of rolling was sufficient to effectually bind the metal, although the rolling was persisted in until the metal was damaged by the extensive crushing action of the roller.

It is generally agreed that any description of binder which is used in conjunction with water should be used sparingly, with a view to filling the voids only, as an excessive quantity of binding material will have the effect of keeping the units of stone apart, and will be washed out in wet weather or exuded as the result of traffic pressure in damp weather, thus causing the road crust to lose its even surface.

SCARIFYING.

The question of the scarifying of existing road surfaces previous to partial or entire resurfacing is one concerning which road engineers entertain somewhat divergent views, but it may be stated, as a general proposition, that scarifying is only justifiable when the existing road surface or crust consists of sufficient thickness of one grade of material to ensure that the foundation of the road shall not be disturbed by the operation. In such cases the surface may be safely scarified and cleaned by screening out the binder and small aggregate, adding such a quantity of new material as will bring the road up to the required strength when re-rolled; but if the structure of the road is at all weak, a new coating of material should be superimposed on the whole work and the edges and ends only should be picked up or scarified to ensure a satisfactory join between old and new work.

If scarifying is necessary, it will be better and more economically done by machine than hand, always assuming that the extent of the work to be so carried out justifies the employment of a machine scarifier. In works of small character hand picking or scarifying may be judged to be more economical.

REPAIRS.

Concerning the important detail of road maintenance, which is comprehended under the general term "repairs," much may be written. When dealing with "water-bound" roads the methods of repair adopted appear to be very largely governed by the personal predilections of individual surveyors, one section of whom rely principally on what may be termed the continual-patching methods, while others prefer the complete re-coating method. Possibly a system which includes both methods is the more to be preferred. On the one hand the patching method requires a fair amount of skill for its proper performance, and, if carefully and consistently carried out, will render a road more comfortable for traffic; but it will not entirely eliminate the necessity for occasional re-coating, inasmuch as it is next to impossible to restore by this method the exact amount of wear to which any given road is subjected. On the other hand, it often becomes necessary, even when a road has been resurfaced, to undertake repairs to weak places or potholes which may show themselves from time to time.

It has often been a subject of conjecture as to why a recently resurfaced road should develop potholes on its upper surface, when the whole of the resurfacing material is, theoretically at all events, of similar texture or hardness, and the author has arrived at the conclusion that this may be due to the fact that, where potholes do occur, the granite or other material has been originally spread rather more thickly at those places than on the general body of the work, and in the subsequent steam rolling the material on these high places has been more damaged or weakened by crushing under the influence of the rolling, thus rendering the road weaker at the very points where, in the first instance, a slight excess of material had been inadvertently or unskilfully applied.

The principal defects connected with the repair of road surfaces may be said to be—

(1) Unskilful application of materials.
(2) Application of unsuitable materials.
(3) Inadequate amount of materials employed, resulting in the "starving" of the road.
(4) Insufficient supply of labour and consequent neglect.
(5) The employment of unskilled or unskilful labour.
(6) Neglect of proper consolidation of materials even in small patching work.

It is as perfectly possible to over-metal a road as it is to jeopardise its condition by a too sparing use of material; a surface over-coated will be less likely to be strong and homogeneous in structure than one to which has been applied a sufficient but not too generous a coating. It should never be forgotten that the principal strain to which the average road is subjected is that of the frictional and attritional wear on its surface, and therefore if a just sufficient thickness of resistent material is applied to the surface the under-coating or sub-structure may be quite properly formed of a softer or cheaper material, as it has only a dead-weight load to sustain and transmit to the earth foundation, and is not subjected to the other influences above mentioned.

The suitability or adequacy of foundation, and the character of the sub-drainage of a road are other important elements which cannot be overlooked or neglected in considering the question of road maintenance or administration, as it would be of little use to look for successful results with whatever skill or care a road had been repaired if its foundation or drainage was either insufficient or unsuited to its purpose, and no hard-and-fast rules can be laid down in this connection which would be appropriate to all circumstances.

With respect to the general question of foundations to ordinary country roads, it often happens that one is not bound to observe such fixed surface levels as it would be necessary to observe in towns or places where kerbs and channels are already laid; therefore it will often be found sufficient in order to strengthen a weakly founded road to leave what foundations may already exist, and apply a coating over the same of a thickness sufficient to render the road strong enough for the work it is called on to do.

The author has also on many occasions strengthened a weak road (especially on clay subsoil) by strengthening or buttressing the shoulders. This is done by excavating trenches of, say, 1 ft. 6 in. wide and deep on each side of the road next the edge or verges, and filling these trenches to the surface of the road with gravel or chalk flints of 4-in. to 3-in. gauge, well rolled down. These side buttresses not only serve to drain the soil under the road (outlets at intervals and in low places being provided), but are of considerable assistance in counteracting the lateral "spread" of the subsoil, which is very often the cause of collapse of the road surface.

For the better protection of the surfaces of roads constructed under the water-bound system the application of a surface coating of distilled and dehydrated tar will be found to be ultimately economical, especially if a dressing of fine granite chippings is spread over the surface immediately after the application of the tar preparation and rolled in; but before this surface coating is applied the road should be brought up to a proper surface contour. This treatment, however, can only be said to have a relatively temporary effect, and it will be found to be more economical, so far as the ultimate result is concerned, to incorporate the tar compound in the structure of the road surface once and for all than to apply it repeatedly to the road surface.

Aggregates and Fillers for Bituminous Road Construction.—An article on this subject, illustrated by photomicrographs, will be contributed to our issue of next week by Mr. E. J. Lovegrove, M.INST.C.E., borough engineer and surveyor of Hornsey.

Waterproofing of Cement.—We learn that an additional plant has recently been installed in the Harrogate electricity station, and that after excavations had been made there was trouble with running water. Pudlo was then incorporated in the cement as a waterproofing medium with excellent results. Although there is a stream in close proximity, the interior of the building is perfectly dry.

Thames Floods.—A conference of the urban district councils of Walton, Esher and the Dittons, and East Molesey was not in favour of the county council suggestion for the formation of a board of control over the river Mole. An alternative scheme for improving the course of the river and minimising flooding has been drawn up by the surveyors to the three councils, the estimated cost being about £3,000.

Housing Conditions in Montgomeryshire.—Mr. Edward Powell, presiding over the quarterly meeting of the Montgomeryshire Insurance Committee at Newtown, commenting on the bad housing conditions still prevailing in the county, said that the great trouble they had in Wales with tuberculosis was due principally to those conditions. It was decided to make representations to the district and county authorities and property owners concerned with the object of improvement.

AGGREGATE FOR GRAVEL CONCRETE.

AMERICAN TESTS.

At the request of the Indiana Sand and Gravel Producers' Association, Prof. W. K. Hatt, Director of the Laboratory for Testing Materials, Purdue University, has conducted a series of tests with the object of ascertaining the relative strength of concrete (1) when the line of division between the fine

Fig. 1.—Gravel Passing ¼-in. Sieve and Held on ⅛-in. Mesh.
(Two-thirds full size.)

and the coarse aggregate is the ¼-in. sieve, and (2) when the line of division is the ½-in. sieve.

At the outset it should be explained that American specifications for concrete usually state that the fine aggregate or sand "shall be graded from fine to coarse, and passing, when dry, a screen having ¼-in. openings," and that the coarse aggregate "shall be retained on a screen having ¼-in. openings."

It was felt by the association mentioned that economical results would be secured by grading the fine aggregate down from ¼-in. instead of ¼-in. gauge, and

Fig. 2.—Gravel Passing ½-in. Sieve and Held on ¼-in. Mesh.
(Two-thirds full size.)

by grading the coarse aggregate up from ⅛-in. instead of ¼-in. gauge. Therefore they wished to have authoritative information as to the relative strength of concrete proportioned in accordance with the two bases in question.

As a matter of general interest we may point out (says the September issue of *Ferro-Concrete*) that in the best British practice the so-called line of division between sand and aggregate is fixed at ¼-in. gauge. Thus the "Mouchel Standard Specification for Ferro-concrete" states that the sand "shall be a mixture of coarse and fine grains from ⅛-in. gauge downwards," and that the aggregate "shall be of assorted sizes, not less than ¼-in. gauge."

The same specification requires that "any stones of more than ¾-in. gauge shall be rejected or broken to correct size." This requirement is of importance in the case of ferro-concrete work, where the concrete must be sufficiently fine to enable it to fill the moulds completely, and to cover the reinforcing bars in a

Fig. 3.—Sand Passing ¼-in. Mesh and Grading Down to Dust.
(Two-thirds full size.)

satisfactory manner. As the tests made by Prof. Hatt related to plain concrete, there was no special reason for limitation of the maximum size of the particles of stone to ¾-in. gauge, and the maximum was settled at 1¼-in. gauge for the minimum sizes of ¼-in. and ¼-in. gauge.

Further, as the object was merely to obtain relative results for comparison one with the other, the concrete for the principal tests was proportioned by volume in the arbitrary proportions of 1:2:4. In some supplementary tests other proportions were adopted with

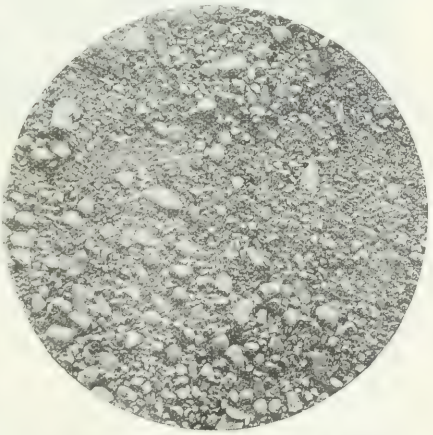


Fig. 4.—Sand Passing ¼-in. Mesh and Grading Down to Dust.
(Two-thirds full size.)

the object of obtaining additional information, but comparisons cannot be made between the series because different batches of cement were used in making up the concrete.

Preliminary tests were made, including the determination of the specific gravity of the sand and gravel, the determination of the effect of contained moisture on the weight per cubic foot and the percentage of voids, and the sieve analysis of the aggregates in a dry state.

The relative value of sand passing ⅛-in. and ¼-in. mesh respectively was determined by tests of 1:3 mortar, and the relative value of sand and gravel graded with the ⅛-in. and the ¼-in. sieve respectively was determined by tests of 1:2:4 concrete tested at the age of twenty-eight days. Figs. 1 and 2 show the gravel with a maximum size of 1½-in. gauge held on ⅛-in. and ¼-in. sieves, and Figs. 3 and 4 show the sand passing ⅛-in. and ¼-in. sieves. In each case the particles are reduced in the photographs to two-thirds full size.

The specific gravity of the materials was as follows:

	lb.	t/m.
Sand	2·65	2·645
Gravel	2·655	2·655

The effect of moisture on the weight and percentage of voids was found to be as follows:—

Moisture per cent.	Weight per cub. ft. lb.	Per cent. Voids.
Sand ⅛-in.		
Dry	111·8	32·4
0·5	109·0	34·2
1·28 ...	99·9 . .	40·2
1·96 ...	98·7	42·25
3·31 ...	99·9 ...	41·3
4·01 ...	101·8 ...	40·7
Sand ¼-in.		
Dry ..	105·2	36·5
1·64	99·4	40·3
1·64	93·7	48·9
2·36	92·8	44·8
3·18	93·4	45·0
4·94	95·3	45·0
Gravel ⅛in.		
Dry	105·8 .	34·1
Gravel ¼in.		
Dry ...	100·7	38·75

As might be expected, the 1:3 mortar tests demonstrate the advantage of well-graded material with a considerable range in the size of the particles. Thus the mortar made with sand ranging from ¼ in. down to dust possessed from 10 to 30 per cent more compressive strength than the mortar made with the finer sand ranging from ⅛-in. downwards. In one case the mortar approached the conditions obtaining in scientifically proportioned concrete, and in the other it was more akin to mortar made with standard sand, which is less conducive to strength than sand consisting of a mixture of coarse and fine particles.

The tests of concrete in the arbitrary proportion 1:2:4 [illegible] the adoption of the ¼-in. line of division between sand and gravel, the results being as follows:—

	[illegible] ⅛-in. basis.	¼-in. basis.
Series I.	3,110 lb. per sq. in.	2,890 lb. per sq. in.
Series II. ..	3,610 ,, ..	3,450 .. ..

Two series of the supplementary tests previously mentioned were made upon concrete with ¼-in. divided aggregate in the arbitrary proportions of 1:2:4, and concrete of ⅛-in. divided aggregate proportioned so as to make it approach more closely than before to the 1:2:4 mixture of the ¼-in. aggregate. The third series of the supplementary tests was conducted on concrete made with aggregate of ¾-in. maximum gauge (as required by the Mouchel Standard Specification), one set of test specimens being made up using material divided on the ¼-in. sieve and another set using material divided on the ¾-in. sieve. The proportions of the concrete were similar to those in the first two series of supplementary tests. The following are the average results obtained:—

	[illegible] ¼-in. basis.	¾-in. basis.
Series III. ...	2,540 lb. per sq. in.	2,118 lb. per sq. in.
Series IV. ...	4,090 ,, ,,	3,620 ,, ..
Series V. ...	2,655 ,, ,,	2,375 ,, ..

As before mentioned, comparisons must not be made between the different series of tests owing to the use of different qualities of cement. Nevertheless, the various results are sufficient to indicate the advantage of the ¼-in. line of division, according to which the sand is graded from ¼ in. downwards, and the aggregate is graded from ⅛ in. upwards.

D.C.M. for Road Sweeper.—It is reported that H. G. Bee, a sweeper in the service of the Kensington Borough Council, who enlisted in the Howe Battalion of the Royal Naval Division in September, 1914, has been twice mentioned in despatches by Sir Ian Hamilton, and has been given a medal for conspicuous gallantry, and also a Distinguished Conduct Medal.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Northallerton R.D.C. (October 6th. Mr. P. M. Crosthwaite.)—£10,000 for the new waterworks at Osmotherley, in the area of the rural council.—Mr. E. Sandeman, the engineer, submitted details of the new works and mentioned the unexpected difficulties which had arisen which necessitated the further borrowing powers.

Salford T.C. (September 29th. Mr. George L. Pepler.) This was an inquiry into an application for permission to put into operation the Housing and Town Planning Act, 1909.—The town clerk, Mr. L. C. Evans, stated that the corporation were anxious to put the town planning scheme into operation, and the land they proposed to include covered about 2,290 acres. It was situated in various parts of the borough, and as it was all land likely to be developed the corporation sought the powers so that there should be a proper scheme of sanitation and road making. When the Act was passed the Bridges and Buildings Committee drew up a plan of all vacant land, irrespective of ownership, and all interested were asked to see that plan and give their views. Conferences had been held with the representatives of the Ship Canal Company and others who objected to the scheme, but these had failed to bring about a satisfactory settlement. On behalf of the corporation he would say that they had not the least desire to harass landowners. In fact they were prepared to give them every encouragement, because it was in the corporation's interest to do so, especially in warehouse-building, when higher rents meant increased rates. Under the Act owners would have more protection than they had now. The building surveyor, Mr. F. W. Platt, said that, had the Salford Corporation had the powers they now possessed forty years ago, Salford would have been a very different place. Apart from secondary streets, the main thoroughfares would have been made much wider, and the people would have enjoyed three times the breathing space they had to-day. Continuing, Mr. Platt said that since the opening of the Ship Canal there had been a considerable growth in the building of property, especially warehouses and workshops, and when normal times were reached again a much bigger growth was anticipated. On the Crescent area, where property belonging to the Booth's Charity was situated, there were some thirty-four different owners, and for uniformity alone it was necessary that the corporation should enjoy the powers given by the Act. This was once a residential district, but in course of time it would be all occupied by warehouses. In the north the development would be of a residential character. Mr. E. B. Martin, the borough engineer, said the corporation was most anxious to assist landowners, and no obstacle would be put in the way of developing any of the plots. In other towns, where he had gained experience, he found that owners had benefited considerably by the provisions of the Act.

Scarborough T.C. (October 7th. Mr. P. M. Crosthwaite).—This was an inquiry with respect to the financial aspect of the works at the new bathing pool and adjacent establishments. The question which the Local Government Board is to consider is whether the corporation should be allowed to proceed with certain works, which are claimed to be necessary for the protection of the cliffs. After hearing the views of members of the council, both for and against the continuance of the work, the inspector visited the site.

APPLICATIONS FOR LOANS.

Cambridge T.C.—£3,000 in connection with the new Guildhall buildings.

Epsom U.D.C.—£1,000 for a motor fire engine.

Hull T.C.—£2,665 for two motor fire engines.

LOANS SANCTIONED.

Chesterfield T.C.—£5,000 for new electricity plant.

Luton T.C.—£4,000, balance of a loan of £24,000 for electricity purposes.

Newport (Mon.) T.C. £8,327 for a refuse destructor.

Rotherham T.C.—£2,500 for extensions at the electricity station.

Wednesbury T.C.—£2,000 for the installation of a rotary converter at an electricity sub-station.

SLATE BEDS.

Mr. Dibdin's slate-bed process is fairly familiar to [illegible] at works in practically every part of the United [illegible] of those towns in which it is actually at work will not fail to be interested in an illustrated pamphlet [illegible] issued. A notable point of difference between this [illegible] dozen pages in only two do the firm trouble readers with their own views with regard to the merits of the system; the remainder of the space, apart from that occupied by several interesting photographic views, is taken up by what others say about it.

"Artificially improved land treatment" is the description which the company applies to the process.

The efficacy of the system is admirably illustrated [illegible] beds, treating the whole of the sewage, only about [illegible] similar period.

Sane Economy.—A retrenchment scheme, prepared by the Westminster City Council, suggests that no bedding shall be purchased this year for the public gardens.

Shrewsbury Municipal Munitions Scheme.—At a [illegible] Alderman W. G. Cross explained the scheme the governors of the Borough Technical School had formulated for enrolling skilled workers to assist in the manufacture of munitions at the school. The head master (Mr. White, B.Sc.), Alderman Cross said, had thrown all his energies into the work, and was re-[illegible] voluntary

[illegible] SLATE BED.

Many surfaces of naturally formed mud containing [illegible] worms are superimposed and supported on slate shelves separated by cubes of slate, so that complete drainage and aëration are obtained in working. When a bed is filled with sewage, the solids in suspension very quickly settle in the 2-in. spaces between the slates on to the thin deposit of mud (about ¼ in. thick) formed on each slate naturally from previous charges of sewage, and covered with a film of bacteria, which instantly commence to spread and multiply over the freshly deposited sewage solids, which act as a new food supply.

When the effluent is discharged from the slate beds fresh air fills the beds, and thereupon numerous [illegible] rise to the surface of the mud to obtain oxygen (perforating and so aërating the mud), and deposit upon the surface, in the form of worm casts, the indigestible matters and humus residue from the previous solids, thus partly burying the freshly deposited sewage matter. As the bed is again filled with sewage the first gentle flow of the rising water washes the worm casts loose, and they are carried down in time from layer to layer of the slate, and finally to the floor of the bed, and out with the effluent as "humus," the quantity being in proportion to that of the solids sent into the beds and its character being similar to the [illegible] completely rotted manure.

[illegible] Their [illegible] room for more Engine and tools had been given locally, and a firm of engineers had offered to make all the castings required gratuitously. He believed this was the first scheme of the kind promoted by any municipal department in the United Kingdom.

Hostile Air Raids: Police Warning (Official).—In view of the possibility of further attacks by hostile aircraft, the Commissioner of Police deems it advisable to call attention to the public warning published on the 28th June, recommending residents to remain under cover, and advising them, for dealing with incendiary fires, to keep a supply of water and sand readily available. The opportunity was taken of suggesting that chemical liquid fire extinguishers should not be purchased without a written guarantee that they comply with the specification of the Board of Trade, Office of Works, Metropolitan Police, or some approved Fire Prevention Committee. Many dry-powder fire extinguishers are much advertised. The Commissioner warns the public, as the result of experiments made, at his instance, by a competent Committee of Experts, that no reliance can be placed upon such appliances for effectively controlling fires such as are likely to be caused by bombs, explosive or incendiary. The Commissioner is advised, as the result of these experiments, that the provision and prompt and intelligent use of water or sand or of both, in dealing with such outbreaks of fire is the best, simplest, and most economical safeguard.

Sanitary Progress in Peru and Bolivia.*

By H. J. BINGHAM POWELL, M.INST.C.E., M.I.MECH.E., Late Engineer to the Principal Municipalities and Government of Peru; also to the Bolivian Government.

The outbreak of bubonic plague at Callao, the principal port of Peru, in the early part of 1903, directed the attention of the authorities to the urgency of serious sanitary reform in the country. The disease . . . is now endemic in Peru, but not in a virulent form, since the mortality only averages about 25 per cent of the cases, which of late years have been but few.

The most prevalent disease on the Peruvian coast, where the principal towns are situated, is tuberculosis, and this must largely be attributed to the inferior mode of living and the unhealthy homes of the lower classes, their food having a low nutritive value, and their habitations being damp and badly ventilated.

The population of Lima is 150,000.

The working classes have but poor notions of personal cleanliness, and it is difficult to make them appreciate the value of this and other matters pertaining to hygiene. Nevertheless, the progress made of late years in sanitary matters is marked, due to the interest now taken by the educated people, to the beneficial effects of legislation, and to the advantageous results of a propaganda instituted by the newspapers and other public organs. Credit must also be given to the Government for its progressive policy in furnishing funds and otherwise fostering the study and execution of such works as sewerage, water supply, hospitals, &c., in the principal towns. The municipalities have contributed their share to the good work by enforcing the public health laws, and by making regulations relating to such matters as the notification of contagious diseases, removal of sufferers to isolation hospitals, pure milk supply, slaughter of cattle in new and properly designed public abattoirs and the inspection of meat, house construction with burnt bricks and reinforced concrete, &c.

The author was appointed by the Peruvian Consul-General in London, and arrived in Lima in 1903 at the moment when the outbreak of the bubonic plague was creating great alarm; thus no time was lost in rapidly getting to work on his mission—that of designing and carrying out the necessary reforms and extensions to the old sewerage system, and later a study of the water supply with a view to its reconstruction.

LIMA SEWERAGE.

The sewerage of Lima was put down some fifty years ago, and is of the defective design current at that period. The sewers take the form of brick conduits with vertical walls and semi-circular roof and invert, built of inferior brick laid on edge, and with lime and sand (chiefly the latter) joints; there is no watertight backing, so the leakage is excessive. These large sewers are difficult to keep clean, and enormous volumes of water are thrown into them to carry away the deposited matter; this water was formerly utilised afterwards for the irrigation of fruit and vegetable gardens in the outskirts of the town, and even in the more central districts.

Nearly all the sewers in a bad condition have now been replaced by stoneware pipes from 9 in. to 18 in. diameter. The irrigation ditches and conduits in the urban perimeter have been abolished in the greater part, and the use of polluted water for the cultivation of foodstuffs for human consumption prohibited. The whole installation has been thoroughly ventilated by 4-in. diameter shafts placed at frequent intervals alternately with air-inlet pipes of the same diameter, and fitted with mica flap-valves. The sewage is conveyed by several main sewers to small rivers in the neighbourhood of Lima, which are used as irrigation canals.

Although the matter of a single outfall to the sea has been carefully studied, no progress towards its construction has been made, as, under the existing irrigation laws, which are very stringent as to hereditary rights to the water in this rainless territory, it has been found impossible to get the landowners to forego their claim to all water proceeding from Lima for the benefit of their properties. This stumbling-block, doubtless, will be removed in the near future, but until then, and notwithstanding the extensive improvements that have been made, the sewerage system will, of course, remain gravely defective from the hygienic point of view.

Large additions to the old installation have been made in the new districts and avenues, and separate outfalls for these constructed in concrete and steel. Finally, a department of the municipality to deal with the house connections has been established, and domiciliary visits are made by competent inspectors to ensure strict conformity with the sanitary laws, and to certify that the installations for new buildings are entirely satisfactory. Pipes of 4-in. diameter, with an intercepting trap properly ventilated, have replaced the former large house drains. The sanitary arrangements of the theatres, hotels, railway stations, and other places of public resort are now on modern lines. The principal hospital, the Dos de Mayo, merits special mention; here a very complete drainage and water supply system has been executed and the ventilation reformed.

WATER SUPPLY IN LIMA.

The existing water supply of Lima dates from 1865, and although some 8,000,000 to 10,000,000 gallons per day are distributed to the 150,000 inhabitants the quantity is insufficient, because the consumers have acquired very prodigal habits, through lack of control over waste, and this abuse has resulted in the want of water now being felt. The authorities have arrived at the conclusion that it would be difficult to improve matters by reducing the supply per inhabitant, and have decided on extensive additional works to bring the total quantity up to 20,000,000 gallons per day.

Fortunately, even this enormous volume of water can be brought to Lima without excessive expenditure. The supply is drawn from the gravel beds that lie under the surface clay at a site some 3 miles up the valley behind the town, and taken at a depth from 20 ft. to 30 ft. below the surface level by filtering galleries and wells; by extending and adding to these, and carrying out similar works on a neighbouring site, all the water required can be obtained. The valley mentioned is steep, and, although so near, the source of supply is at ample altitude over Lima to give a large pressure.

At present the non-existence of a service reservoir and the inadequate pipe distribution result in the working pressure being very low in some districts, and almost nil in other parts of the town. These defects will be corrected by the construction of large reservoirs at a convenient level, and the renewal and extension of the pipe distribution to cover the whole urban area, which contains, or will contain in the near future, 70 miles of streets. The new works are to be commenced without delay, since the old concession held by the water company has recently expired, and a Water Board has been constituted with members representing the municipality, the Government, and other interests.

CALLAO.

The drainage, water supply and desiccation of the subsoil of the port of Callao presented several very interesting problems. Many physical difficulties had to be taken into account, especially in the design of the sewerage system. The town is on an isthmus that is very flat on the sides by the sea, the slope here not being sufficient to permit of the sewers having self-cleansing gradients with gravitation outfalls. Therefore the area has been divided into three zones, two of which discharge to the sea by the aid of Shone ejectors, and the third at a higher level at the back of the town, by gravitation, utilising one of the steel outfall jetties of the other zones.

The sewers are from 6 in. to 18 in. diameter (no rainfall entering the system, as is the case with all the other installations described, since the Peruvian coast is practically rainless), and laid on broad concrete bases in the decomposed clayey earth that forms a great proportion of the subsoil, where the water level is within 18 in. from the surface in many places. At first it was impossible to get these bases to set properly, but that trouble was finally overcome by laying the concrete in light wooden troughs to keep out the mud and flowing water. The compressor station is well built in brick and concrete,

* Extracted from the "Journal of the Royal Sanitary Institute" for October.

The Surveyor

And Municipal and County Engineer.

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and houses the air compressors, oil engine, electric motor and work-shops. The manholes, flush tanks, &c., are made of concrete, this being the practice generally adopted by the author in South America for these and other works such as large sewers, service reservoirs, bridges, &c., since no hard bricks suitable for such works are procurable. The whole system is thoroughly ventilated by 4-in. shafts. The house connections have been made in conformity with sanitary regulations similar to those for Lima.

The water supply of Callao is from wells sunk into the gravel beds on a site at a short distance up the valley behind the town. Two million gallons per day are at present taken; but, although the population is only 35,000, the supply is insufficient, and further wells and filtering galleries are being constructed on the same site, to increase the quantity to 3½ million gallons per twenty-four hours. A service reservoir of 800,000 gallons is to be built, and the distributing pipe system extended.

OTHER PERUVIAN TOWNS.

The sewerage of Arequipa, the second largest town in the country, does not present points of peculiar interest. It is a gravitational scheme, and the discharge is to treatment works (intermittent downward filtration) on a sandy formation. The subsoil is dry, and no bases are necessary to carry the sewer pipes, which are from 6 in. to 18 in. diameter.

The water supply is from pure mountain springs 7 miles from Arequipa. The water is brought to the town through conduits laid in unlined tunnels and piping; as it is found that contamination occurs in the tunnels, especially where these are near to the surface, a continuous steel main is to be laid on supports on the floor of the conduits, thus conveying the whole supply by pipes. Additional headworks are required to bring the quantity per day up to 2,000,000 gallons, for a population of 45,000. A service reservoir of 1,000,000 gallons capacity will serve to break the high pressure in the latter section of the pipe-line, in addition to its usual functions. The pipe distribution will be by high and low level zones, because of the somewhat large fall of the town, which is on the slopes at the foot of the famous volcano "El Misti."

The sewerage of the Trujillo is a gravitational scheme, and the discharge is on to a large tract of desert land between the town and sea. Reinforced concrete bases carry the pipes in wet ground, and the outfall is of cast iron. The water supply comes from a river, and is of potable quality at the intake, but heavily charged with suspended mineral matter at certain periods of the year. To remove this, large sedimentation tanks, of capacity equivalent to two and a-half days' consumption, and mechanical filters in a reinforced concrete building, are to be put down. The town distribution is to be finished, and has been laid out for a daily supply of 600,000 gallons. A large service reservoir completes the installation.

The water supply and sewerage of Chiclayo may be considered together, inasmuch as it has been arranged to obtain the former from tubular wells with air-lifts, and the latter, because of the almost complete flatness of the town, is on the ejector system; thus the compressor station will provide the compressed air required for both installations. The sewerage will be discharged through a rising main to septic tanks and percolating filters. The formation is a waterlogged clay, and so the deeper sewers are to be of cast iron. The water supply of 900,000 gallons per twenty-four hours will be distributed in the town in four zones, the principal pipes radiating from a large service reservoir on columns to be situated in the principal square, in the middle of the area; in this manner equality of pressure and distribution will be obtained, although the town is so flat.

Ica is another town where tubular wells have been utilised for the water supply (470,000 gallons per day); here also air-lifts are to be employed to raise the water, since ordinary pumps with moving parts are found to wear badly because of the high content of sand in the water. The sewerage is to be by gravitation, with discharge to a site of loamy formation with a top layer of alkali.

Ancon is a seaside resort on a slightly shelving sandy beach; the sewer pipes are laid on reinforced-concrete bases, and the flushing water is obtained by pumping brackish water from a well near the sea. The motive power is given by a windmill or oil engine, as the case may be. There is a long steel outfall jetty. Potable water is brought daily from Lima in tank cars.

Miraflores is another seaside town, and the sewage flows to a septic tank on an unfrequented beach; from this the liquid portion escapes through the honeycombed walls, under the shingle, and thence to the sea.

A final point of interest in connection with sanitary matters in Peru is that of the disposal of the refuse of the towns. At present the refuse is conveyed by carts to outlying tip-heaps, and many of these are of great antiquity, in some cases as old as the town itself, a matter of three to four centuries, and have reached an enormous size. The underlayers of the old heaps are now formed of consolidated mineral matter, as the organic solids have decomposed and disappeared with time, and so the only objection to the tip-heaps arises from the recent deposits. The question of dust destructors has been seriously studied, and even definite plans drawn up, but it is doubtful if such installations would be of particular value in Peru owing to the nature of the refuse, which has but small combustible value because of the absence of domestic coal fires.

BOLIVIA.

Progress in sanitary matters cannot be said to have made much headway until quite recently, for the drainage projects to be described were only first taken in hand by the author as late as 1912. In a way this delay may be considered advantageous, because the several schemes have all been drawn up together and based on the same principles; thus the installations will be of a uniform character and efficiency for the whole country.

Of the six large towns in Bolivia, the complete definite plans have been completed for four, La Paz, Cochabamba, Oruro, and Potosi. Respecting the other two, Santa Cruz is so far away from any railway that the cost of public works where imported materials have to be used is almost prohibitive; and with regard to Sucre, the problem was about to be studied when the outbreak of war in Europe compelled the Government to stop for the time being all further expenditure on public works.

In 1913 a Bill was presented to Congress authorising the executive to raise a loan of £1,400,000 for the purpose of executing the drainage schemes for the four towns mentioned, and, in addition, for Sucre. The negotiations for this loan were proceeding favourably, but the war has, of course, stopped them until better times.

The policy of the Government is to execute the works under one contract and thus extend the uniformity of design to the quality of the workmanship, with the consequent benefits to the success of the undertaking.

In Bolivia there is not as yet any public health department to deal with sanitation works; such matters are in the care of a section of the public works department, and it must be said that the heads of the department and the several ministers that have been in charge have displayed great zeal and foresight in the execution of their mission.

The water supply of the towns is under the same department, except that of La Paz, which is controlled by the municipality. The latter installation

takes the water from a storage reservoir formed by a dam across a narrow gorge, and conveys it to the town in a 20-in. steel main. Some contamination occurs from irrigation and mining ditches in the watershed, and steps are being taken therefore to suppress these. The pipe system is to be extended, the town being divided into zones of supply to equalise the pressure, a service reservoir will be built in each of these districts. Sucre has a very well designed and constructed installation. Cochabamba is to take the water from wells and filtration galleries, Oruro from springs, and Potosi from the old conduits constructed by the Spaniards for the mines, these drawing water from a series of small storage reservoirs situated at some distance away. For the last three towns mentioned steel pipes have been purchased, but have not been laid down, except in Oruro, where some progress has been made.

SEWERS.

Returning now to the drainage schemes and treating of details common to all, cement pipes are to be used for sizes from 6 in. to 21 in., and reinforced concrete for sewers of larger diameter. This construction is preferable to stoneware pipes for the smaller sewers because of the inaccessibility of the towns from the coast and the consequent high freight charges for imported materials; this is a consideration, apart from the matter of breakages, which would be 50 per cent for stoneware pipes coming from Europe, none being manufactured in the country. For the larger sewers stone could also be employed, but experience of this material in similar works has demonstrated that there is not enough skilled labour at hand for the great quantity of highly finished masonry that would be required; this factor and the difficulty of getting sufficient high quality stone at a reasonable price are the reasons why stone sewers would cost two or three times as much as concrete sewers, even although the cement for the latter has to be imported and heavy freight charges paid.

For La Paz and Potosi the concrete sewers will be of circular section, because of the ample gradients, and not reinforced with steel, as the largest diameter is only 51 in., or within the minimum size where practical economy is given by reinforcement. On the other hand, in the Cochabamba and Oruro schemes the gradients are flat, and therefore egg-shaped sewers are required to obtain self-cleansing velocities. Because of their large size, the egg-shaped sewers will be reinforced to reduce the cost, and also to strengthen the structure to provide against the weak foundation given by the poor subsoil, which is waterlogged in the districts of the towns where such sewers are to be built.

The tubular sewers will also be carried on broad reinforced-concrete bases in all cases where the ground is not firm.

The manholes are to be of concrete, and not reinforced where of rectangular cross-section, as in the La Paz and Potosi projects. For the other two towns the manholes will be circular, and constructed of reinforced concrete to conform with the respective sewers.

Tri-dium tank, will uniformly be of plain concrete with flat reinforced-concrete roofs.

The detritus chambers of the street gullies will be of rectangular section and in plain concrete. In the cases where the streets have a large fall there will be a side rectangular opening in the pavement kerb to provide a by-pass direct to the sewers, should the gratings become covered with vegetable or other matter putting them out of service. To avoid this happening, however, the gratings for such streets have been designed with the bars curved in a direction diagonal to that of the flowing water from the street gullies; with this arrangement any deposited matter will be pushed to one side, and the grating left free.

Also, where the streets are exceedingly steep, the sewers have gradients stepped-down at the manholes, the differences of level being made up by "down-pipes." These down-pipes are in cast iron, and with a trap at the foot, where entering the manhole, to break the velocity of fall of the water and to prevent the rising of the gases to the higher districts of the town—an eventuality that must be allowed for in such very hilly towns as those under consideration.

The ventilation systems are very complete, 4-in shafts being provided in all cases.

In Bolivia rainfall has to enter into the calculations for fixing the sizes of the sewers. As a rule the precipitations are not of long duration, but heavy at times; also the rainfall only extends over four to five months of the year. For the towns that have been studied the total annual rainfall is from 20 in. to 30 in., and the maximum intensity observed has been ½ in. per hour and lasting fifty minutes, marked by the self-recording gauge in La Paz.

The sewerage works have been designed on the basis of maximum precipitations at the rate of ¾ in. to 1 in. per hour, and one-half to two-thirds of this entering the sewers, the latter depending on the slope of the town and the nature of the ground.

Storm-water overflows have been designed at convenient points to allow the excess rainfall to flow away from the street sewers directly to the nearest watercourse, and relieve the outfall sewers from carrying more than five times the dry-weather flow, thus adopting the rule observed in England. Nevertheless, in spite of the great reduction so made in the quantity of rainfall carried by the outfall sewers, these reach the large size of 6 ft. by 9 ft. in the case of the Cochabamba and Oruro schemes.

THE ROAD BOARD.

GRANTS TO HIGHWAY AUTHORITIES: TWENTIETH LIST.

During the months of July, August and September, 1915, the Road Board indicated additional advances to highway authorities, amounting in the aggregate to £38,687, of which £33,713 was by way of grant, and £4,974 by way of loan.

The advances made and indicated from the constitution of the board up to September 30, 1915, less indications cancelled, amount to £6,170,966. Of this total £4,719,466 is by way of grant, and £1,451,500 by way of loan.

GRANTS FROM THE ROAD IMPROVEMENT FUND.
July, August, September, 1915.

Highway Authorities.	Amount of grant for			
	Improvement of road-crusts.	Road widenings, corners and diversions.	New roads and bridges and reconstruction of bridges.	Total.
ENGLAND.	£	£	£	£
Berkshire	2,400	—	—	2,400
Buckingham	3,685	—	—	3,685
Cambridge	3,031	705	—	3,736
Cornwall	3,467	—	—	3,467
Cumberland	289	—	—	289
Derbyshire	6,267	—	—	6,267
Essex	22	—	—	22
Hereford	170	—	—	170
Isle of Ely	923	—	2,727	3,650
Kent	15,156	—	—	15,156
Lancashire	—	—	1,800	1,800
Northumberland	4,030	—	—	4,030
Rutland	400	—	—	400
Salop	5,037	—	—	5,037
Somerset	1,458	—	—	1,458
Southampton	69	—	—	69
Stafford	10,408	—	—	10,408
Surrey	2,871	—	—	2,871
Worcester	3,500	—	—	3,500
Yorks (N.R.)	5,210	—	—	5,210
WALES.				
Anglesey	645	—	—	645
Denbigh	736	—	—	736
Glamorgan	4,596	—	—	4,596
Pembroke	707	—	—	707
SCOTLAND.				
Argyll	236	—	—	236
Ayr	1,648	—	—	1,648
Caithness	100	—	—	100
Dumbarton	65	—	—	65
Fife	250	—	—	250
Haddington	642	—	—	642
Inverness	55	—	—	55
Kincardine	37	—	—	37
Kinross	275	—	—	275
Lanark	1,400	—	—	1,400
Linlithgow	3,765	—	—	3,765
Midlothian	3,000	—	—	3,000
Perth	460	—	—	460
Ross and Cromarty	400	—	—	400
Stirling	750	—	—	750
IRELAND.				
Tipperary S.R.	521	—	—	521

The formal grants completed, with the approval of the Treasury, during the last quarter, amounting to £94,013, were applied as follows:

Road crust improvements	£88,781
Road diversions	705
Reconstruction and improvement of bridges	1,800
New roads and bridges	2,727

Law Notes.

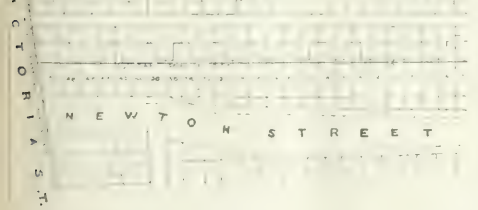
The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only, and addressed to "The Editor, at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—*i.e.*, without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. The letter X, combinations such as X.Y.Z., and words such as "engineer" and "surveyor" should never be used.

TEMPORARY BUILDINGS: APPLICATION OF BY-LAWS.—"Vedras" writes: In this district it has been the practice to allow the erection of temporary buildings composed of wood and corrugated iron, subject to the owners entering into an agreement to pull them down when called upon to do so, and on paying the cost of the agreement, which is usually drawn up by the council's solicitor and stamped. At a meeting of the Health Committee a plan was submitted for an extension of a gymnasium belonging to a public school, and was shown composed of corrugated iron with wood matchboard lining. Exception to the plan being approved was taken by one of the members, who is a solicitor, his grounds for objection being (*a*) that the building does not conform to the building by-laws, being a building of a temporary character; (*b*) that these agreements which are entered into by the owners of temporary buildings are of no use, seeing that the owner may dispose of the business, and, the successor not having signed the agreement, the council cannot compel him to take down the building, he not having contracted with the council to do so. What kind of building is construed as coming within the term "temporary building"? [illegible] The real point as to whether the building in question is a "new building" to which the by-laws apply [illegible] It was held by a majority of the Court that the Public Health Act, 1875, as to the building by-laws framed thereunder, contemplated buildings of a permanent character, and not mere temporary structures which in the [illegible] and Act was meant merely to control that it was not of a permanent character. The question whether a particular building is permanent possibly does not depend upon the intention to be construed would be considerable [illegible] the material used in the construction of the building. If the building in question is not in fact a temporary building, it must comply with the by-laws (except [illegible] relating to the partial exemption of iron buildings), and the council have no power to sanction plans which do not so comply. [illegible] Future trouble might be avoided by applying to the Local Government Board for an order applying [illegible] of the Public Health Acts Amendment Act to the district.

BURST WATER SERVICE PIPE: LIABILITY TO REPAIR.—"A. T. B." writes: I should be much obliged if you would [illegible] Law Notes" who you consider is responsible for the repair of a burst in the [illegible] supplying water to



houses Nos. 2 to 50 Newton-street, as shown on the enclosed drawing. The burst pipe is in the house No. 10 Newton-street. You will see that this service pipe is supplied from a 4-in. iron main laid by the corporation in Victoria-street, and the whole of the service pipe as soon as it enters No. 50 Newton-street is on private ground, and was put in by the builder when the houses were erected. Nearly all the houses have since been sold, mostly to separate owners. Do [illegible] (1) the whole of the premises are responsible? (2) or Nos. 10 to 2 only, [illegible] water through the pipe when it is burst? (3) or the owner of No. 10 (the premises where the pipe is burst)?

We think that the owner of No. 10 is liable to repair the pipe. Sec. 57 of the Public Health Act, 1875, incorporates (*inter alia*) the Waterworks Clauses Act, 1863, and sec. 17 of the latter Act provides a penalty in case "any person supplied with water by the undertakers wilfully or negligently causes or suffers any pipe . . . to be out of repair or to be so used . . . as that the water . . . is or is likely to be wasted . . ." We are not aware of any rule of law by which any contribution can be obtained from the owners of any of the other houses.

SALARY: LEGALITY OF REDUCTION.—"Borough" writes: I hold the combined appointment of borough surveyor and sanitary inspector, at a salary of £250 per annum, and, probably that the corporation may receive as large a sum as possible towards [illegible] it is appointed at £150 as sanitary inspector and £100 as surveyor. Some members of the corporation are agitating for my salary to be reduced during the war, although, on the other hand, they are paying a war bonus every week to all the employees of my department. Will you give me [illegible] on the following points, or any other [illegible] me? (1) My salary and appointment as sanitary inspector being approved and sanctioned by the Local Government Board, can the corporation [illegible] with or reduce my salary without the consent of the Local Government Board, and would the latter be likely to support me in any way by withholding consent to reduction? (2) Can the corporation legally reduce my salary as surveyor, [illegible] it is so small, viz., £100 per annum? By the Public Health Act, 1875, they must appoint fit and proper persons to be surveyor, &c., and I [illegible] a salary at least must be paid.

(1) The answer to this question is to be found in the General Order of the Local Government Board, which contains [illegible] conditions as to inspection of nurseries. By Article 14 of that Order, "the sanitary authority shall [illegible] officer such salary as may be approved by us, and the salary is approved when the appointment is [illegible] Article 12 of the same Order deals with [illegible] of duties, and is as follows: "Where any change in the duties of [illegible] any other duties are deemed necessary, and he shall decline to acquiesce therein, the [illegible] authority may, [illegible] and after [illegible] and after [illegible] notice in writing, signed by their [illegible] to such effect, determine his office." (2) By [illegible] of the Public Health Act, the surveyor is removable [illegible] by the authority at their pleasure (see *Hall v. Local Government Board*, 1916, 1 Q.B., 390, subject, therefore, to the terms of the contract of employment as to notice), a surveyor is in the hands of the authority if they decide to reduce his salary.

BY-LAWS: WATER-CLOSET WINDOW OPENING.—"A. Z." writes: Has a builder of a new water-closet complied with local by-laws as regards provision of a window opening 2 ft. by 1 ft., exclusive of the frame, if he, instead of constructing such opening in the usual way, (*a*) has cut 6 in. off the top and 6 in. off the bottom of the door of the water-closet, or (*b*) if he has framed a triangular-shaped opening above the door frame, the frame of which is formed by the top of the door frame itself and the raking rafter of the roof, and the exclusive area of which opening is equal to 2 super. ft.? In the event of (*b*) being regarded as having complied with the by-law, would the fact that the builder fitted fixed louvres in such opening, and by so doing reduced the clear opening as well as having reduced the light in the water-closet, affect the decision?

(*a*) In our opinion this is not a compliance with the by-law, which requires (i.) a window *and* (ii.) adequate means of constant ventilation. This is certainly not a window. (*b*) We think that this also does not comply with the by-law, as it is an opening merely and not a window. It certainly does not comply if its area is decreased by the insertion of louvres.

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, assoc.m.inst.c.e.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

Mr. James G. Wilkin, of Downpatrick, who was awarded the premium for September, has chosen "The Principles of Waterworks Engineering," by J. H. T. Tudsbery and A. W. Brightmore (E. & F. N. Spon, Limited), and this book has duly been sent to him.

QUESTIONS.

This week answers are invited to the following questions:—

505. Retaining Wall.—Design a retaining wall in reinforced concrete, giving detailed calculations. The height of proposed wall 35 ft., earth retained, dry gravel; foundation similar. (H. T.)

506. Concrete Sewer Construction.—Is it necessary to support concrete sewer tubes with concrete at the sides, the tubes being 21-in. diameter? If it depends on the depth below the street whether they should be supported by concrete or not, then what are the least and greatest depths at which they can be laid without concrete support at the sides? ("Polox.")

507. Design of Retaining Walls.—What are some good, practical rules for the design of (1) brick and (2) concrete (not reinforced) retaining walls to withstand earth pressure? ("Polox.")

508. Street Construction.—Some new streets are to be laid out involving considerable cutting and filling of the ground. Longitudinal sections of the ground showing the levels of the new road have been prepared. The cutting and filling have to be measured up as the work proceeds. What is the best method of doing this? (Polox.)

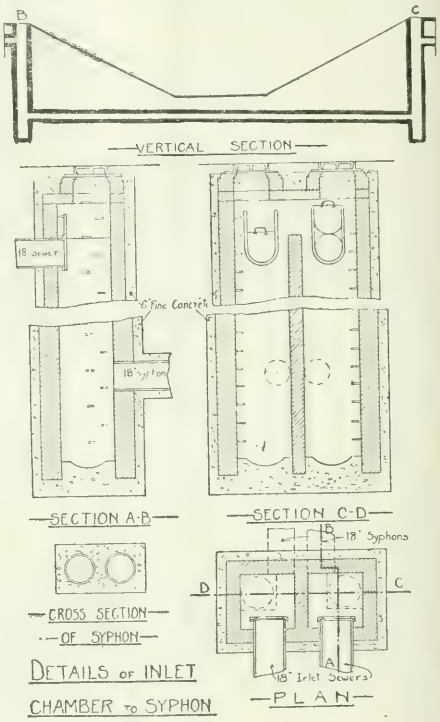
509. Sewerage.—A 12-in. sewer, laid at a gradient of 1 in 50, has an average depth, dry-weather flow, of 1 in. How would you calculate the depth of six times the dry-weather flow? A leaping weir is fixed 12 in. below the outlet of the pipe. At what distance should the edge of the weir be fixed from the outlet of the pipe to take all above six times dry-weather flow? Give mathematical and graphical calculations. ("Pennbourne.")

REPLIES TO QUESTIONS.

503. Sewer Construction.—AB and CD are two 18-in. stoneware pipe sewers, intercepted at right angles by a railway in a cutting with slopes of 1 in 2. The fall of AB is 1 in 140 and CD 1 in 360. The invert level of B is 122·5; C=120·75; ground level 128·0, and level of railway metals 106·50 ft. above ordnance datum. Distance from B to C is 110 ft. Describe and show by sketches in detail how to connect the sewers AB and CD, showing provision for cleaning and inspection. The fall of both sewers is towards D. The railway company will not allow any sewer to pass underneath the railway unless at a greater depth from top of sewer to top of rails of 4 ft. (E. H., *Walkden.*)

The following additional reply to this question has been received since our last issue:—

The only method of connecting the two sewers so as to comply with the railway company's regulations is by means of an inverted syphon. These must always be regarded as necessary evils in a line of sewers, and consequently should be made as short as possible. For this reason, the sewers should be brought as near to the railway cutting as possible, or is permitted, and a manhole built somewhat as shown in the details. The general arrangement of the syphon is shown in the vertical section. As syphons are liable to get blocked up, they should be provided in duplicate, which is also necessary for cleaning purposes. The two syphons should be communicating, so that if one gets blocked up the other comes into operation. This can be accomplished by a construction somewhat as shown in the details. The inlet sewer should be divided into two by a Y junction, and each branch controlled by a valve, so that either syphon can be in use separately. It would perhaps be better construction if the sewer ran into a penstock chamber from which the two branches ran to the syphon manhole, but the other arrangement works in practice. The manhole itself should be of any



convenient size, say 6 ft. by 3 ft., divided into two compartments by a 9-in. partition wall, increasing in thickness in the lower parts if rendered necessary by the depth. This ensures that if the syphon in use gets blocked up, the sewage flows over the division wall, and the other comes into operation. It also acts as a relief in times of storm in cases where the syphon has not such a large discharging capacity as the inlet sewer. At the bottom of the manhole a catchpit about 4 ft. deep should be built to prevent grit and other detritus from entering the syphon. Steps should be provided to the bottom for cleaning purposes. In some cases a chain is passed through the syphon during construction, to be dragged to and fro in case of stoppage, so as to clear it, but its value is doubtful. A good fall should be given to the syphon pipe itself to facilitate cleaning, say 1 in 50, or 2 ft. in this case. The fall given has no effect upon the discharge of the syphon, which is entirely due to the difference of level between the inlet and outlet inverts, in this case 122·50−120·75=1·75 ft. The working levels in this case will be—

Level of rails		106·50D
Depth of sewer below rails ...	4′ 0″	
Diameter of sewer	1′ 6″	
Concrete	6″	
		6·0
Level of invert at rails		=99·50D
Fall in syphon	2″	
Level of invert of syphon at inlet ...		101·50D
Level of invert of syphon at outlet ...		98·50D

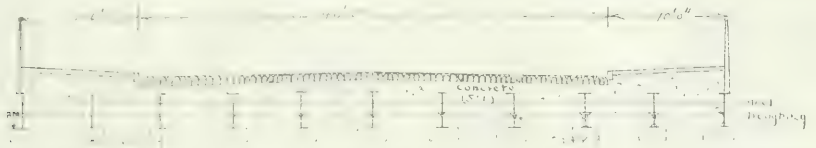
The outlet manhole is practically identical, but the reverse of the inlet, and so no details are given.

As to the usual methods of construction can be adopted, the syphon being of cast iron or stoneware ... The manholes should be faced inside with blue brick, or rendered in cement. It will probably be found that the railway company will insist upon the trench up to the permanent way level being filled with concrete, as is the case to the writer's knowledge. (J. A. R., *Chatham*.)

[Note.—Replies to Question 504 will be published next week.—Ed.]

504. Bridge Design.—A bridge is required to carry a 60-ft. street over a canal, the clear span being 40 ft., the minimum head room being 11 ft. at centre and 9 ft. at sides above normal water level. The approaches are rising gradients of 1 in 24 and 1 in 90 respectively. Sketch the bridge you recommend for such a position, giving all important particulars, short specification tests for materials, and tests for bridge when completed. (P. W., *Pontypridd*.)

As no particulars are given as to the amount and character of the traffic of which this bridge is supposed to carry, but seeing that the width is 60 ft., it is assumed that it is intended for heavy city traffic. The first question to consider is the particular type of construction—viz., either of the following: (1) The brick arch bridge, 2 masonry bridge, (3) steel girder bridge. The difference in



Sketch 1.

headroom allowed is only 2 ft., and as it would be necessary to have about 8 ft. (to allow for curvature) in the case of a brick arch bridge, this difference in headroom could not be obtained except by considerably raising the roadway in the centre, which should be avoided, owing to the existing steep gradients. This would also be the case if a masonry bridge was erected; also if either of the first two were erected you would require a compensation along the canal. The steel used should be mild steel, capable of bearing ultimate tensile stress of 28 to 32 tons, and elongation of 20 per cent in 8 in. Rivets should bend double when cold without signs of fracture. All girders, &c., should be true on their edges and free from flaws, and receive one coat of red lead before being delivered on works. The whole of the cement used shall be best Portland and in accordance with

Sketch 2.

siderable time for building and setting. Therefore we will consider the erection of a steel girder bridge. Suppose the width of carriageway to be 40 ft., and width of footpaths at each side 10 ft. respectively. As the width of the bridge is greater than the length, it would be most economical to place the main girders parallel to the direction of the road. Sketch No. 1 shows built-up girders at 6-ft. centres, with steel troughing levelled up with concrete (5:1), to the required contour of the road. Sketch No. 2 shows built-up girders at 6-ft. centres, but with brick jack arches in between and the spandrels filled in with concrete (5:1), as in No. 1 example. The latter makes a very good flooring, only the dead-weight of the structure is much greater than the former. In calculating the sizes of the girders and decking, take the maximum live load as a traction engine drawing a boiler on a wagon. The weight of engine equals 16½ tons (14 tons on back axle and 2½ tons on front. The weight of boiler equals 32 tons. The wheel bases, 14 ft. 6 in.; track, 6 ft. 6 in. Front wheel of wagon to back wheel of engine, 14 ft. 6 in., and in the case of the troughing the weight is assumed to be concentrated on two sections of troughing, and distributed through a cone of the material under it, having its apex at the point where the load is resting, and its apex angle being 90 deg. Also take a uniform load of 1 cwt. per foot super. for a crowd load. Main girders, ¼ cwt. per super. foot; granite sett pavement, at 1 cwt. per super. foot; jack arches, at 1½ cwt. per super foot. In finding the sizes of the respective girders, draw the bending moment diagram for dead loads and add to it the bending moment diagram for the live loads, which load, + 25 per cent, is assumed equivalent to dead load. Having arrived at the total bending moment to be provided for, the next thing is to design the main girders by means of the following data: Depth is generally taken from $\frac{1}{12}$ to $\frac{1}{10}$ span; width not less than $\frac{1}{30}$th of span; minimum thickness of web, $\frac{5}{16}$ in.; ∴ depth, say 3 ft., and width 1 ft. 4 in. Note.—In plate girders it is usual to assume that all the shear is carried by the web, and that all the bending moment is taken by flanges (deducting rivets). Then, using formulæ MB (max.)=fAD. The working stresses used for the materials are: Steel in tension, 6½ tons per sq. in.; steel comp., 6½ tons per sq. in.; steel shear, 6 tons per sq. in.; steel bearing stress, 10½ tons per sq. in.

Stiffeners.—General rule that spacing should not exceed ⅜ of depth near abutments, and ⅝ of depth of girder towards the centre. The bearings at the ends of girders should be lead pads, at least 6 lb., on stone templates to evenly distribute the weight. The abutments should be of the best engineering or stock bricks in cement-mortar, and taken down to solid foundations, and should be protected from being damaged by barges, &c., British Standard Specification. The concrete to be composed of 5 of hard broken brick or stone and 1 Portland cement. All stone to be laid on its natural bed or quarry bed, and free from flaws and uniform in colour, and same obtained from approved quarries. For purpose of testing the bridge, the bridge is loaded as designed, and the deflection measured in several places by the aid of special sensitive instruments. (E. H., *Walkden*.)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

Maintenance of Herefordshire Roads.—At a meeting of Malvern Hills Conservators recently the chairman (Mr. F. Ballard) said the Highways Committee of the Herefordshire County Council could not recommend that the application from the conservators that the Jubilee-drive should be taken over as a main road be entertained at the present time. There was a movement, which he favoured, for putting all the main roads in Herefordshire entirely under the management of the county council. If such a thing came about, the conservators might renew their application, but the county authority were cutting down expenses in every direction.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Housing and town planning—Hemsworth; roads and [illegible] Dunbartonshire; Uckfield; sewerage and sewage disposal—Goole; water, gas and electricity—Derby, East Lothian, Edinburgh, Wednesbury, Wimbledon. Particulars of other projected works will be found on the Local Government Board Inquiries page.

BUILDINGS.

Ayr T.C.—It has been agreed to make a grant of £500 to the trustees of the defunct Ayr Merchant Company, which have fallen to the town, to the Ayr Carnegie Library for the purpose of building a children's reading-room and library.

Derbyshire C.C.—Inconsistency on the part of the Local Government Board was suggested in the Health Committee's report. Whereas on August 31, 1914, the department represented that a large increase of hospital accommodation for enteric fever and small-pox might be required, it had now refused to sanction loans for proposed extensions to buildings belonging to the North Derbyshire and Chesterfield Joint Hospital Committees. In the latter case the plans had been approved and work commenced before the receipt of this notice, and the local committee were accordingly pressing for the loan.

Tottenham U.D.C.—The cost of laying down the floor of the first-class bath and taking it up again at the end of the season having been eliminated from the estimates, the engineer, Mr. W. H. Prescott, stated in answer to a member that the work would be done by the council's own men.

Truro T.C.—The Public Works Committee report their decision to place on record their appreciation of the care, attention, and ability shown by the city surveyor (Mr. F. Barnes) in placing the council chamber, mayor's parlour, and committee-room in such a satisfactory condition after the fire a year ago.

HOUSING AND TOWN PLANNING.

Barnsley T.C.—The medical officer has been instructed to report on the housing conditions in the borough.

Chipping Sodbury R.D.C.—Owing to the fact that work in connection with the Town Planning Act, 1909, has been very largely suspended, it has been decided to dispense with the services of the assistant inspector of nuisances.

Hemsworth R.D.C.—It has been agreed to proceed with the housing scheme, consisting of fifty-two houses, as far as possible.

Market Harborough U.D.C.—At a council meeting recently Mr. Douglass stated that the surveyor, Mr. Herbert G. Coales, had prepared a plan which was now before them in connection with the town planning scheme. It was an open question in many places whether such a scheme should be brought into force now, but the clerk and the surveyor were of opinion that it was advisable they should make a start with it, even if they did not go further, because it gave certain powers to the council to prevent what they might consider a wrong development of the district. The clerk, Mr. H. Lindley, said the general idea of the scheme was that, if the land was scheduled for town planning, the council could say where roads could go, and which part of the town could be used for building factories and which could be used for residential purposes, and they could limit the number of houses to the acre. The matter was adjourned to [illegible] opportunity [illegible] the [illegible].

REFUSE COLLECTION AND DISPOSAL.

Cardiff T.C.—The city engineer, Mr. W. Harpur, mentioned to the Health Committee the method of rubbish disposal in use at Southwark, where, he said, refuse was reduced to a light soil, which was sold at a profit to gardeners and nurserymen. He recommended that when the corporation considered the question of a destructor this method be carefully considered. The committee expressed appreciation of the suggestion, but pointed out the matter was not yet under consideration.

ROADS AND MATERIALS.

Acton U.D.C.—The surveyor, Mr. F. Sadler, reported that several residents in Springfield Park had called attention to the necessity of removing or lopping some of the large street trees (elms and poplars) in the neighbourhood. Several large street trees required attention this autumn. As the council's gardener, who generally carried out the tree work was now in the Army, and there was no employee competent to do the work, he (the surveyor) was obtaining an estimate from a local woodman, an expert, for (1) severely topping and lopping the trees in Creswick, Mayfield, and part of Lynton roads; (2) removing the large elm tree in South-parade and two poplars in Hardwick-road; and (3) removing two dead trees in Wales Farm-road. The estimate was now presented, and was stated to be 5s. per tree, the number of trees being about fifty; excepting, however, a large tree at South-parade, in respect of which 10s. was asked. It was stated that the Public Gardens Association carried out work of this kind without profit, and it was decided to write to the association on the subject.

Audley U.D.C.—With regard to a proposal to reduce the staff of workmen on the roads, the surveyor, Mr. A. Cotton, reported that thirty men were engaged in the highways and sanitary department, and sixteen of these, including the two foremen, were engaged regularly on work which was essential to the public health and sanitary condition of the district. Eleven men were engaged as length men on the roads, of which there were 40 miles. The remaining three were engaged in doing odd work. With a smaller staff the roads would be somewhat neglected, and as this would not be economy he could not recommend a reduction of the staff. Replying to Mr. Weaver, who had raised this question, the surveyor said the staff in normal times would be at least thirty-five men. The matter was left in the hands of the surveyor, with an instruction to him that he reduce the wages bill as far as possible.

Belper R.D.C.—The council have received the gift of a valuable piece of land near Denby Station from Major Drury-Lowe, for the purpose of widening a length of road. An improvement is also to be carried out near Denby Church.

Bodmin R.D.C.—The chairman of the Finance Committee, Mr. T. H. Dyer, in presenting the half-yearly estimate, which showed that about £2,000 would be required, said there was no necessity at these times to go in for road widening and the taking off of corners, but the public should understand and keep the right side of the road. It was astonishing how many people kept on the wrong side of the road, and if the public understood the necessity of keeping to their proper side there would be less necessity for councils to widen roads or alter corners. If they practised economy in the direction indicated they could manage on the 9d. rate, and he moved accordingly. The southern surveyor, Mr. J. Knight: Mr. Dyer has mentioned about the right side of the road. Which was the right side? Ninety-nine out of every 100 motorists drove in the middle of the road. Mr. W. E. Menhinick: That is one for the surveyor.

Brighouse T.C.—The borough surveyor, Mr. S. S. Haywood, has received instructions to obtain tenders for making up Owler Ings-road, and the council have also approved the apportionment, amounting to £190, for making up Spring-street.

Cardiganshire C.C.—A special committee has been appointed by the Northern Main Roads Committee to consider the supply of road material and the question of haulage. Some members considered that more local stone should be made use of, and the county surveyor, Mr. T. E. Owen, said it did not pay to haul stone for a greater distance than 5 miles. When the two representatives from the Road Board were down they said that some of the local stone was equal to anything they could wish to have. They recommended the purchase of a motor lorry to carry the stone. Such a vehicle would not damage the roads much, and would travel at a good rate.

Cheshunt U.D.C.—The council have accepted the tender of Messrs. W. Griffiths & Co. for the supply of Guernsey granite at 14s. 11d. per ton at Cheshunt

Station; 14s. 6d. per ton at Theobalds Grove Station; and 14s. 9d. per ton at Waltham Cross Station, for 2-in. cube, and for other sizes at proportional prices, the same subject to any variation in the rate of freightage over or under 5s. per ton.

Croydon T.C.—The landowner having agreed to convey a piece of land for the purpose, the borough engineer, Mr. G. F. Carter, has received instructions to carry out an improvement in Brighton-road at the junction of that road with Purley Downs-road. The cost of the work is estimated at £125.

Diss U.D.C.—The council have accepted the tender of Messrs. Edwards, Norwich, at £565, for the repair of Walcot-road, which had been considerably affected by heavy motor traffic. The cost will be met by the Road Board, subject to the urban council contributing £75.

Dumbarton C.C.—With respect to the work of treating with bituminous binding the principal highways in the Western District, the Road Board, on being appealed to for a grant, promised to send an engineer inspector to examine the roads. The council have agreed to pass the specifications as submitted, with the explanation that if the grant was not obtained from the Road Board the expenditure would be reduced to within the amount provided for in the Budget minus the expected grant.

Essex C.C.—An agreement has been reached with the Great Eastern Railway Company for the repair by the county council of roads over the various bridges in the county belonging to the company.

Finchley U.D.C.—The trustees of the Hampstead Garden Suburb propose to construct a road, to be known as Eastholm-road, over the existing sewer, and the council have undertaken to strengthen the sewer at a cost, approximately, of £25.

Finsbury B.C.—The tender of Mr. G. J. Anderson has been accepted for a supply of creosoted deal blocks.

Gateshead T.C.—It has been agreed to pay the street paviors a war bonus of ½d. per hour, increasing their wages to 10½d. per hour.

Godstone R.D.C.—The council have accepted the tender of Mr. F. C. Fuller, at 5s. 7d. per yard, for the supply of grit. The council have also accepted an offer from Messrs. Newmarsh & Roberts of 125 yds. of grit at 2s. 9d. in the pit and 3s. 6d. per yard delivered at Chaldon Common; and also an offer from Mr. W. Hackney, of Warlingham, of 68½ yds. of rough flints at 4s. per yard.—The tender of the Taroads Syndicate, Limited, has been renewed for road tarring at an increase of one-tenth of a penny for Class 1 work on last year's prices, the remaining prices being the same as last year.

Huyton U.D.C.—An intimation has been received from the county authorities that they will be prepared to make grants towards the cost of tar-spraying main and secondary roads.

Inverness-shire C.C.—The County Road Board have resolved to make application to the Road Board for grants in respect of the serious damage to bridges and roads caused in the First and Third Districts by a recent rainstorm.

Molesey U.D.C.—The Highway Committee will ask for £150 for road repairs in the coming half-year, the lowest amount on record.

Swansea T.C.—A reason urged by four men engaged in the work of mixing tar-macadam for an increase of 1s. per day wages was that it was "dirtier" than ordinary labouring work. The work they are employed on is in connection with an experiment the borough surveyor, Mr. J. R. Heath, is carrying out at the dust destructor works. It was explained that when the tar-spraying was introduced the council decided to give the men doing it 2s. per week extra by reason of the dirty nature of the work, but Mr. Heath pointed out to the Health Committee that the work of mixing clinker tar-macadam was not half so dirty as the other. The 6s., if granted, would bring the four men's wages up to 33s. per week, including war bonus. But for the experiment he was making there would be no work for the men. The committee felt that the demand for 6s. was "a bit thick," and referred the matter to a sub-committee for report.

Tottenham U.D.C.—It was announced recently that the Metropolitan Electric Tramways, Limited, had conveyed a piece of land on the west side of the approach to the old bridge, crossing the river Lea on the Essex boundary, for the purpose of widening Ferry-lane.

Walsall T.C.—As a result of further representations to the Local Government Board it is announced that the department have sanctioned the borrowing of £40,000 for the widening of Lower Bridge-street, on condition that no money is raised under the sanction during the next three years. The General Purposes Committee have accordingly decided to proceed with the purchase of the necessary properties, and to give mortgages on the rates for the amount of the purchase money and compensation at an agreed rate of interest.

Warrington T.C.—It is proposed to carry out a widening scheme in Howley-lane.

Witham U.D.C.—Captain Shafto Abrey said his attention had been called to the untidy condition of High-street and the smell given off by uncollected refuse. He found that the council had only one old man engaged on the town streets. The surveyor, Mr. P. Perkins, said he had several workmen ill and others away on jobs. There was such a dearth of labour that he could not get other men to work on the roads. The chairman said it was the same in every business, and ratepayers would have to learn to overlook little shortcomings at the present crisis, because there were not men to be had. Mr. E. Smith: And they must learn not to bring these small matters before us. Captain Abrey: This is not a small matter; it concerns the health of the town and the appearance of the streets. The chairman: We cannot keep things up to concert pitch now.

Worcester T.C.—An agreement has been reached with respect to the proposed widening of Tybridge-street.

Uckfield R.D.C.—The surveyor, Mr. E. Johnson has received requisitions for the improvement of a number of roads for military purposes.

SEWERAGE AND SEWAGE DISPOSAL.

Bacup T.C.—An agreement has been made with the Rawtenstall Corporation to carry out sewerage works in Booth-road, on the basis of Bacup making a contribution of £116 towards the cost.

Exeter T.C.—The city surveyor, Mr. T. Moulding, has submitted to the Sanitary Committee a report on the works required to be carried out at the Belle Isle and St. Thomas sewage works. The committee resolved that copies of the report be distributed among the members of the committee, and that a special meeting be called to consider it.

Goole U.D.C.—The Highways and Sewers Committee recommend the council to make application for a further loan of £4,000 for works of sewerage.

Ottery St. Mary U.D.C.—New filter beds are to be provided at the sewage disposal works, at a cost of about £100.

Southwick U.D.C.—Upon the suggestion of the surveyor, the council have decided to lay an 18-in. sewer in South-terrace, at an estimated cost of £120, the work to be done by the council's workmen.

Southwick-on-Wear U.D.C.—It has been decided to carry out sewerage works, at an estimated cost of £120, the work to be done by direct labour.

Sunbury U.D.C.—The Local Government Board have sanctioned the loan for £900 for a gas engine and plant at the sewage disposal works, to be repaid within fifteen years. The surveyor to the council, Mr. H. F. Coales, will instruct Messrs. Bilbie, Hobson & Co. to supply the engine and plant and air compressor, at £836, as soon as possible.

Ystradgynlais R.D.C.—The completion of the sewerage scheme is to be deferred till after the war. Already a sum of £13,000 has been spent on the work.

WATER, GAS, AND ELECTRICITY.

Derby T.C.—The Electric Lighting Committee recommend the town council to carry out electrical extensions, at an estimated cost of £3,300, and to make application for sanction to a loan for the work.

East Lothian C.C.—The Western District Committee advise the county council to spend an additional sum of £1,300 on works of water supply at Kingston.

Edinburgh T.C.—The city council have approved the Electric Lighting Committee's recommendation to accept (1) the tender of Messrs. Fraser & Chalmers, Erith, for turbines and alternators for the new power station at Portobello (with Messrs. Vickers as the makers of the alternators), at £23,251; and (2) the tender of Messrs. Fraser & Chalmers for condensing plant (with Messrs. Richardsons, Westgarth & Co., Hartlepool, as sub-contractors), at £7,611, delivery

in the case of both contracts to be made in the summer of 1917.

Leeds T.C.—It is understood that the Home Office have issued an order permitting the lighting of two-thirds of the street lamps, numbering nearly 10,000.

Wednesbury T.C.—It is proposed to take up a loan of £5,641 for street works, electric lighting, the erection of a school, and the provision of pleasure grounds.

Wimbledon T.C.—The Electricity Committee recommend that the town council should seek sanction to a loan for electrical extensions.

MISCELLANEOUS.

Barking U.D.C.—The acting surveyor, Mr. R. A. Lay, reported to the Town Planning Committee that, as directed, he was making inquiries with regard to the probable cost of acquiring various sites that had been suggested as suitable for the establishment of a municipal market, and would report in due course. It was resolved that the acting surveyor submit to the next meeting of the committee definite information of the properties that would have to be acquired on each of the alternative sites suggested, together with estimates of the cost.

Epping U.D.C.—It has been agreed to purchase 500 ft. of hose and two branches for the fire brigade.

Finsbury B.C.—The tender of the Co-operative Bass Dressers, Limited, has been accepted for the supply of 24 dozen large Bahia bass scavenger broom heads.

Godstone R.D.C.—Negotiations are in progress with the railway company with respect to a proposed light railway siding at the Oxted highway depot, and the access through the company's gates.

Sandown U.D.C.—The council have obtained from Mr. J. S. Brodie, borough engineer of Blackpool, a report on the proposal of Colonel Stephenson R. Clarke to construct a groyne opposite the Home of Rest, and this has been forwarded to the Board of Trade.

Southwick U.D.C.—In the absence of public lighting it has been decided to whiten the street crossings, kerbs, lamp-posts, and hydrants.—It was reported that the average cost of feeding the council's horses last month was 15s. per horse per week, against a similar figure in the previous month.

Witham U.D.C.—The council have ordered the seal to be affixed to an agreement to purchase from Mr. W. Bindon Blood a piece of land, 3 acres 1 rood (being part of Cock's Farm), at Chipping Hill, for the construction of a new cemetery, for £325, the council to pay costs and compensation to tenants, possession to be taken at Michaelmas.

Manchester Cleansing Department.—In the course of the year ended March 31st last, the Manchester Cleansing Department collected and dealt with 157,293 tons of ashes, 11,700 tons of other refuse, 29,529 tons of warehouse and trade refuse, 6,218 tons of slaughter-house refuse, 4,994 tons of stable manure, and 1,649 tons of fish refuse. From the city thoroughfares and markets 90,434 tons of street sweepings and 4,814 tons of market garbage were collected and disposed of. The total weight of refuse collected and dealt with by the department during the year exceeded 311,000 tons, or over 1,000 tons each working day. As stated in our last issue, the gross expenditure of the department was £221,265, and the income £152,362.

FOR OTHER ADVERTISEMENTS
See End of Paper.

CHERITON URBAN DISTRICT COUNCIL.
ROAD STONE.

The Cheriton Urban District Council invite Tenders for the Supply of 500 to 700 tons of Welsh, Leicester, or other approved hard-wearing Granite.

The stone to be delivered at Shornecliffe Station (S.E. and C.R.), as required.

Tenders, with Samples, to be addressed to the Clerk to the Council, Public Offices, Cheriton, by noon on Tuesday, 19th inst.

WILLIAM R. COVENEY,
Acting Surveyor.

Public Offices,
Cheriton.
October 14, 1915. (2,741)

PERSONAL.

Mr. C. J. Jenkin, surveyor to the Finchley Urban District Council, has been granted leave of absence for a further term of a month.

Mr. George Robert Burbridge, the assistant surveyor, has been appointed surveyor to the Hollingbourne Rural District Council, at a salary of £110 a year.

Mr. W. E. Groves, highway surveyor to the Dulverton Rural District Council, was thrown from his motor cycle recently and injured somewhat severely. He is progressing satisfactorily.

Mr. G. A. Ballard, Assoc.M.Inst.C.E., assistant borough surveyor of Guildford, has received a commission in the Royal Engineers, and at the last meeting of the council he was granted leave of absence during the period of the war.

Mr. A. E. H. Dussek, of the Dussek Bitumen Company, Bromley-by-Bow, has been away from business for the past three months owing to ill-health, but he desires to inform his friends that he hopes shortly to have the pleasure of again meeting or calling upon them.

Mr. E. A. B. Woodward, water engineer to the Wolverhampton Corporation, is recommended by the Parliamentary Sub-committee for an honorarium of 350 guineas in recognition of his eminent services in connection with the Wolverhampton Corporation Water Act, 1915.

Prof. Sidney Barwise, M.D., B.Sc., has accepted the presidency of the Association of Managers of Sewage Disposal Works for the year 1916. Mr. Geo. J. Quick, Brentwood, was elected a member and Mr. Fred. J. Grierson, Sutton-in-Ashfield, an associate, at a meeting of the council held on September 29th.

Mr. J. Sutcliffe, the new borough engineer of Woolwich, is, at the request of the Road Board, to be allowed to render what assistance is necessary in connection with the completion of the large A.S.C. department at the City of London Cattle Market at Deptford, which work has from its inception been under his supervision.

Mr. J. Brierley, divisional surveyor under the Sheffield city surveyor, who temporarily left the corporation service in June last to join the Army, has just been promoted to the rank of Lieutenant in the engineering unit of the Royal Naval Division. Mr. J. Hassall, who also left the department about twelve months ago to join the same unit, and was also promoted to the rank of Lieutenant, has just returned from the Dardanelles seriously ill.

Mr. W. L. Eves, surveyor to the Uxbridge Urban District Council, was, upon his reappointment recently, complimented highly upon the manner in which he had discharged his duties. Mr. Hudson, a member of the council, said he thought that the houses that had sprung up from Mr. Eves' plans and under his supervision were unquestionably some of the nicest municipal dwellings he had been into, while the general laying out of the road reflected more than ordinary credit, and showed that Mr. Eves had done his utmost to make the street, as well as the houses, an ideal place. It was certainly an object-lesson to more than one local authority where they had ventured on the same lines.

Mr. T. H. Yabbicom's appointment as consulting engineer to the Bristol Corporation was the subject of a debate at the council meeting on Tuesday, when Mr. Ayles proposed that it should be terminated. The salary for the first five years, it will be recalled, was fixed at £400, with a reduction afterwards to £250. The chairman of the Sanitary Committee, the *Bristol Times and Mercury* states, made out a strong case for continuing the appointment, showing that Mr. Yabbicomb's services in negotiating the purchase of properties for street improvements had saved nearly £13,000 so far, and that if he did not do the work another officer must be appointed. Alderman Pearson bluntly characterised the movement as a miserable attack founded on miserable arguments. By a vote of forty-eight to seventeen the resolution was rejected.

OBITUARY.

We regret to announce the death, which took place yesterday after an operation, of Mr. E. R. Hewitt, district surveyor for Southwark under the London County Council.

Planning of Working-Class Houses.

THE DISPOSITION OF SANITARY FITTINGS.*

By JOSEPH WEEKES, Burgh Surveyor, Irvine.

[illegible] more attention than it has hitherto received.

It would serve little purpose to dilate on the old type of tenemental and cottage house. We know what has already been done in enforcing the introduction of water and sanitary fittings, and in remedying dark and unventilated water-closet apartments. We know the conditions which prevail regarding the common water-closet apartment variously situated, in many cases proving a menace from a health and morality point of view. Certainly there have been serious structural difficulties in the altering of old houses which have prevented the best results being obtained, but the personal equation has, as often as not, proved a hindrance to reform.

The Local Government Board, acting under the Housing and Town Planning Act, are taking a more serious view of the housing conditions existing in our towns and villages, and although many properties are bound to be demolished under their requirements, many will of necessity come under schemes of reconstruction. It is to be hoped, therefore, that the experience gained in the past will result in a better arrangement being made of the sanitary fittings both in old and new properties. We cannot demolish our towns and take the dwellers to

[illegible]

Let our efforts, therefore, backed up by our Acts of Parliament, result in our houses being altered and planned in a manner compatible with the standard of health and decency which we of this advanced age look for and require.

Take the average tenement house erected in our cities within the past few years. It is quite a common thing to find in the two to four roomed house (1) a bath-room apartment with water-closet and wash-hand basin, and (2) a small scullery, sometimes provided with a wash-tub and boiler. In other houses the scullery is omitted, and the sink is to be found in the kitchen window. In others, again, there is no bath-room, but a well-lighted and ventilated water-closet apartment. Take, again, the housing accommodation of our poorer localities. We find the common water-closet and common washing-house still in evidence, and the number of sanitary appliances reduced to an absurd minimum. I cannot understand why the common water-closet should be tolerated at all in [illegible]

Of course, we all know the plea that the water-closet outside the house is better for the health of the dweller and his family; but is it? If so, why go on perpetuating the inside closet in our dwellings at all? What is the result of the outside closet?—the "night-pail," in many cases. Can anyone blame the use of such when, perhaps, a long passageway has to be negotiated, or a journey has to be made down the stair and across the court with the temperature below zero, as often as not to find the apartment occupied, or that it has been used previously as a "smoking parlour," with all its expectorations on the floor, or in such a filthy condition through the habits of one or another of its past users as to be unusable? . . . But what of this condition of things during times of illness in the household? There is no disputing the fact that many of the loathsome orders of disease and affliction found among our poorer classes can be traced to the common water-closet.

The modern cottage and small flatted house do not, or, rather ought not, to present the same difficulty with regard to the planning of their sanitary apartments compared with the tenement. There is generally plenty of ground, but can it be said that we are improving the planning of our cottages in this respect? Since the English type of cottage has invaded our northern clime it would seem as if a backward tendency had crept into the planning of our small dwellings. The chief aim is evidently to gather the drainage [illegible] The idea is all

* Paper read at the annual congress of the Incorporated Sanitary Association of Scotland.

[illegible] can be carried too far, to the detriment of the comfort of the dweller. Take the average cottage erected under garden city auspices. The

"VALLEY MODERN CONVENIENCE"

means, in most cases, the scullery-washing-house-larder-bathroom and water-closet apartment—a most peculiar combination.

Before entering into the merits and demerits of the scullery with its combination of fittings, let us consider the kitchen and scullery apartments generally, as we find them being erected around us to-day. In the tenement house the scullery-wash-house is a great acquisition, some will say; but it is not every worker who can pay for this necessity. Others may call it a luxury. Of course, in the cottage home the scullery and washing-house apartment is nearly always to be found; we expect it. But in the tenement dwelling the sink and wash-tub are oftenest placed in the kitchen window. Now, we all know of the presence in working-class houses of a bed or beds in the kitchen. Workers who sleep in their kitchens, containing sinks with rotting and decaying woodwork (for it is still common to have sinks and tubs wood-lined), and perhaps a dirty syphon trap, or grease-choked overflow only a few feet from the bed, or who have to inhale while asleep the effluvia from the contents of a tub of clothes put to steep, or the vitiated air following on a day's washing in the kitchen, are not getting a fair chance. Even should there be a common washing-house, is it possible for the mother of a young family to leave her children alone in the house while she does her washing in the washing-house? No; everything must be done in the kitchen.

On the question of the combined water-closet and bath-room apartment some authorities go the length of saying that under no conditions should the water-closet and bath-room be contained in the same apartment. In my opinion this is too sweeping. To attempt to secure in the working-class house separate apartments for the bath and the water-closet would be bordering on the extravagant and ridiculous.

In the scullery of the cottage of to-day you will often find a bath standing in a corner without being partitioned off. It is to be found near to the boiler from which it draws its supply of hot water. A hinged cover presents a good table top when the bath is not in use, which, in its turn, often hides a washing of dirty clothes and various other articles. In other cases the bath is contained in a cupboard and made to hinge down on to the floor if required for use. Consider these expedients. We require privacy while bathing, and how can this be obtained without a properly partitioned-off apartment? The open bath may answer its purpose quite well in the household without a family, or while the children are young; but the observing of common decency must be the first aim in the family life. We know that in many industrial localities a bath is a necessity after a day's toil, and I will leave to your imagination to conjure up the feelings of a father or son who has to take a daily bath under such conditions. Even if, for economic reasons of hot water supply from washing boiler, the bath is put in the scullery, I cannot understand why it should not be partitioned off.

The scullery which has besides a bath a water-closet is also very objectionable. The scullery is the hub of the whole house, for in it is done both preparing of food and culinary work. Do our planners of cottages ever consider the repugnance of the idea of a meal being prepared or baking being done in an apartment comprising water-closet accommodation? In this style of house the kitchen really is the principal lobby, and as a sleeping apartment its privacy is reduced to a farce.

The water-closet apartment is, again, often found placed outside the house, either (1) at the back door, entering off a small porch formed by the scullery door, or (2) at the side of the back door, entering direct from the outside, or (3) in an outhouse, away from the main building entirely. It may be said in favour of No. 1 that the closet can be entered and left by the way of the back door; but this is not always convenient, especially after dark, and here, again, the kitchen as a passageway enters into the

[illegible] the only conceivable point is that one closet is provided for each house, but the main objection is that the [illegible] the use of the commode. Generally, these three latter arrangements present definite examples of bad planning, the underlying idea evidently being that, so long as sanitary accommodation is provided, it matters not where; but it must be cheaply done.

I should like to say a word here as to the

RESPONSIBILITY OF THE LOCAL GOVERNMENT BOARD

in the matter. The model plans for cottages approved by the board show the collective arrangement of scullery, and I know of local authorities which have had to alter their plans to the board's requirements to embody the objectionable features I have mentioned. No doubt the board are actuated by the desire to help on cheap housing schemes, giving as much accommodation as possible in a limited space, but cheapness ought not to be paramount in the housing problem.

Having referred to the various methods of providing sanitary fittings presently in vogue, I should like to set down what, in my view, should be aimed at in all new houses. Let every house, no matter if even of the one-roomed variety, have its separate water-closet, and be planned so as to have that water-closet inside the house. Then, and only then, will some advance towards the teaching of cleanly habits in certain classes be made easier, even if by way of the police court. In each house a well lighted and ventilated scullery-wash-house ought to be provided. It need not be a large apartment, but fitted with sink and tub. If hot water be laid on so much the better, and if not a gas or coal boiler should be provided, planned so that the mother can keep an eye on the kitchen fire—the death-trap of so many young children while the mother is at the washing-house. On no account should a sink or tub be allowed in the kitchen sleeping apartment, or a water-closet be within or open off the scullery. In houses with baths, if the bath has to be housed in the scullery, let it be properly partitioned off, and the apartment properly lighted and ventilated. As for the outdoor water-closet, abolish it entirely.

Naturally the

FINANCIAL SIDE OF THE QUESTION

is a serious one. It may well be asked whether the supplying of sanitary appliances arranged as I have advocated can be done and the houses let at economic rents. Would such further burdens not stop speculative building entirely? The expense would, no doubt, be greater, and I dare say that the rents would have to be slightly raised. But are these really burdens? Are our workers, however humble and poor, not entitled to bring up their families under proper conditions of health and morality? I claim that they are.

In the cottage or flatted house the effort to save a soil stack or a few yards of drain is often the reason for the badly situated water-closet.

I will here give some illustrations of plans of houses I have come across wherein this penny-wise policy has been followed out.

In No. 1—that of a block of four houses in the flatted system—we have pantry and water-closet apartments in the scullery. The four water-closets are placed so that one soil stack serves the lot. Would the plan have lost anything if the pantry had been shifted over to the division wall, and the water-closets made to open off the entrance lobby? The additional cost would have been one extra soil pipe, but this would have almost been made up by the fewer yards of drainage required.

No. 2 plan also shows a block of four-flatted houses, with sculleries, &c., as before. There is on each floor a press—on the ground floor under the stair, and in the upper floor over the start of the stair. These presses have windows, and are intended as wardrobes; but I know of an effort being made to use one as a bed closet. Would the plan not have been improved by utilising them as water-closets? The cost would not have been any more, and I think you will agree that the convenience of the house would have been improved fifty-fold.

No. 3 is a plan I saw illustrated. It is of the three-roomed, double cottage order. The scullery-washing-house has an open bath, sink, and water-closet apartment. It is evidently intended to get the hot water for the bath from the boiler in the corner, and waste pipes are very well arranged for. I have, however, taken the liberty of shifting the outshoot from the back to the side, and although I have reduced the principal apartment slightly (it can quite well stand it), I think the altered conditions would more than compensate for this reduction. The area of ground covered is certainly greater, but the increase of cost thereby is more apparent than real when you consider the simplified roofing and the minimum of thick wall required through the concentration of the vents. The frontage would require to be slightly increased, but in these days of the housing "unit" this problem ought not to enter so much into the question as formerly.

As a last example, let us consider the plan for double or continuous cottages, with attics, which we find springing up around us, and having a minimum of frontage. The bath is open, and the water-closet opens direct out of the scullery. Would the additional cost of a partition around the bath have amounted to a great sum? It could have been made of the folding order, if it were considered that the scullery would have been too small to allow a partitioned-off bath-room. The space of the so-called bedroom, which is only 6 ft. square, should have been partly utilised for the formation of a water-closet apartment. The question of a porch at the front, wherein the closet could be placed, might also be considered.

I am sorry to say that there are types of houses being erected, especially in our industrial centres, which are of

THE IMPOSSIBLE-TO-ALTER ORDER,

so far as the situation of their sanitary apartments are concerned; but I cannot deal with them within the limits of this paper.

My endeavour is to show how certain types of plans could have been altered, and, to my mind, improved, at very little cost, involving little or no increase in rent to the tenant. They are all houses of the kind for which there is a demand at present, and for which good rents are to be got.

Briefly, let us examine what powers we have under our Burgh Police and Public Health Acts to regulate the plan of houses with regard to the disposition of their sanitary fittings. Schedule 4 of the 1892 Burgh Police Act states that there shall be, to the satisfaction of the local authority, sufficient water-closet accommodation in connection with the building. Sec. 246 of the same Act gives powers to local authorities to enforce the introduction of water-closet accommodation, but this section refers to old properties. Sec. 251 deals with the situation and dimensions and general construction of the water-closet apartment. Surely the word "sufficient" of Schedule 4 is enough for our local authorities whereby to insist on a water-closet for each house? As custodians of the public health, are they doing their duty in permitting the common water-closet at all in new properties at this late stage in sanitation, with this power to work on? And I would ask, Is the common case of one closet among four tenants sufficient for their needs? Sec. 246 has served its purpose to a certain extent, but its wording with regard to the water-closet has given too much latitude to many in respect of the common apartment. Under sec. 251 no local authority need have qualms with regard to their laying down the law as to where the water-closet should be situated.

As regards the Public Health Act, the local authority of any district can, subject to the approval of the county council, formulate by-laws under sec. 181 whereby the arrangement of sanitary appliances is practically in their own hands.

We have no powers to insist on the introduction of baths and sculleries, &c., in our houses, but these points ought to be kept in view for future legislation.

In the meantime indications point to our local authorities having to tackle the housing problem themselves, as private enterprise is not keeping up with public needs. Let it be our first consideration therefore to see that even the poorest classes are provided with thoroughly healthy houses. I think this can be done without materially increasing the cost of building, if thought and care and commonsense are brought to bear in the working out of the details of the plans—especially in relation to the provision and disposition of the sanitary fittings.

Tarmac.—"J. A." writes: Will surveyors who have laid tarmac having an aggregate of Guernsey or other hard granite kindly state whether they have found its wearing capacity equal or superior to that of tarmac composed of a softer stone, such as slag or limestone?

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Now that the Government have sequestrated the income of the Road Board, shall we not expect to have some very bad roads in places during the war? What will be the result of this policy? If the roads are allowed seriously to deteriorate, will there not be a rather serious "day of reckoning"? How will this be met? Will the Departmental Committee upon the effect of heavy motor traffic give us some relief when the result of their deliberations are published?

* * * *

Why is it that the camber of the roads in and near Woolwich is so excessive? Is it, as one may shrewdly suspect, the result of laying the tramway lines at too high a level? Was not this fault at one time almost universal? And is this not another reason why these railways should never have been allowed on our streets and roads?

* * * *

Why should Mr. James Shiels, of Kilrea, Ireland, be so much disturbed in his mind because on some nights that town is without light for half an hour after the time it ought to be provided? Would Mr. Shiels be surprised to hear that we, in London, don't get any light at all?

* * *

Is not the Surveyors Institution of Engineers to be congratulated upon its growth since its formation in 1911, when we find that the roll of membership is no less than 511 at the present date? Is it not further to be warmly congratulated upon the fact that out of this number no fewer than thirty members are helping their Mother Country in fighting the Germans? Was not Mr. W. Ingham, the present distinguished president, at one time a municipal engineer in this country? And will not all his friends heartily wish him a successful year of office as president of this energetic institution?

* * * *

Can we hope to see shortly such an improvement in the adaptation and price of electricity as will lead to a revolution in our present methods of obtaining heat and power in our dwelling-houses? Would it not almost completely solve the smoke nuisance problem if this consummation could be reached? But will it not be a long time before the price of electric current can be so reduced as to compete successfully with the coal fire or gas stove for heating purposes? Is not the recent action of the Glasgow Corporation in opening show-rooms of electrical domestic appliances to be heartily commended?

* * * *

Are not the trees in the beautiful avenue which runs from Buckingham Palace to Charing Cross planted a little too closely together? Has it not been laid down somewhere that the best distance to allow between street trees is half a chain, or 33 ft.? And are not the trees in this avenue planted about 25 ft. apart? Will they not crowd each other out in the course of a few years?

* * * *

How is the water-bound macadam road in Hyde Park going to stand the motor-'bus and other heavy traffic which has been diverted on to it during the repairs to the wood pavement in the lower portion of Park-lane? Will it not be rather interesting to see whether the expensive form of macadam road which the Office of Works still retains in this park and elsewhere will bear the strain of modern traffic upon its surface?

* * * *

Who is Mr. Barry Low, of Welwyn, Hertfordshire who has written to the council of that county complaining of the methods adopted by the county surveyor in the repair and maintenance of his roads? Is it a fact, as stated by that gentleman, that tar and clay are used together to make up the roads, and that tar is expected to adhere to wet granite? Is not Mr. Low's indictment so scathing that it would appear to be exaggerated? And if Mr. Low is not an expert road maker, is it not possible that he has misunderstood the position of affairs altogether?

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—The rapid increase of sand wastes around our coasts is indeed a serious one, and Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

ALGAE GROWTHS ON SEWAGE FILTERS.

[In the early part of October, 1914, there began to appear on the upper surface of the stones in the sprinkling filter-beds at the Peachtree Creek sewage treatment works at Atlanta a growth that was later classified as blue-green algæ, belonging to the *Oscillatoria* family, and in an article in *Engineering Record* Mr. Charles C. Hommow, chemist and bacteriologist in charge at Atlanta, describes how nearly a ton of this material was removed from 2½ acres of beds.]

The growth was first noticed forming around the risers and nozzles, but soon spread in a fine green film over the whole surface of the filter-bed. It appeared that the nozzles formed a sort of nucleus, or starting point, for the growth, which gradually became thicker and thicker over the whole bed until in March of this year it was ½ in. thick in places. The heaviest growth extended approximately 3 ft. from each nozzle.

The top surface of the growth was dark green in colour, while the middle and underneath portions were dark brown. It was leathery in texture and quite firm. When the growth was in a healthy condition it clung very tenaciously to the stones, and sometimes when picking up a piece of it six or eight stones would be so firmly bound together by it that they could be carried from the bed without dropping off. In places it caused considerable pooling of the sewage, but at no time was this serious.

GROWTH DRIES IN APRIL.

In the middle of April, however, the growth began to dry up in places, break loose from the stones, and apparently was going to sluff off and pass through the beds. Some of the pieces were 6 in. square, and, having thus sluffed up the lower layers of the filter medium or the underdrains, an attempt was made to remove the growth by raking it off. This was not found practical, so labourers were set to work picking it off by hand. It was found that by letting the growth dry from four to five hours it practically freed itself from the filter medium, and pieces as large as 3 ft. square could be picked up.

The filter effluent contained considerably more suspended matter for a few days after the beds were cleaned, but they went back to normal, and the stones in the beds at the present time are practically as clean as they were before the beds were put into service two years ago. Except for the first few days after the beds were put back into operation there was no apparent difference in the quality of the effluent after the growth was removed. The excellent condition of the filter-beds during the spring and summer months suggests the possibility that the matted growth over the surface during the winter held the suspended matter back, and thus prevented the usual clogging that takes place in filters during the colder months. The underneath portion of the growth of algæ appeared to contain material filtered out of the sewage, and there is no doubt that a great deal of suspended solid matter was held back, and much of it oxidised by the algæ, which are known to consume a considerable quantity of nitrogen. This class of algæ does not give off oxygen to the same extent that some of the other algæ do, but the oxygen they did give off and the suspended solids held back and partly oxidised must have been beneficial to the filters during winter.

EFFECT OF COLD WEATHER.

The writer believes that these growths ought not to be disturbed during cold weather, or as long as they remain in a healthy growing condition and cling tightly to the surface of the stone, but when they threaten to break up and pass on through the filters it is time to put the filters out of service, allow the growth to dry out, and remove it.

Cheap Baths Water at Lewisham.—At Wednesday's meeting of the borough council the Lewisham Baths Committee reported continued satisfactory results from the working of an artesian well and the erection of a new concrete water-storage tank at Ladywell. All the water required for the swimming baths at Ladywell during the past season—viz., 12,950,000 gallons—had been obtained from the well, at a total cost of £72 3s. 11d., or about 1¼d. per 1,000 gallons; if obtained from the mains of the Water Board the cost would have been £323 15s. It would thus be seen that, after allowing for the yearly repayment of the loan and interest (£68 10s.), a very substantial saving had been effected.

CORRESPONDENCE.

Εις ἀνηρ οὐ παθ' ὁρᾶ
(One man does not see everything.)
—Euripides.

"SLIPPERINESS."

To the Editor of The Surveyor.

Sir,—With reference to the last paragraph in the column of "Things One Would Like to Know" in to-day's issue, there is a Lincolnshire dialect word "slape," meaning slippery, and it is possible that "slapeness" would be quite as expressive as "slipperiness," and would fulfil the desire of your correspondent.—Yours, &c.,

H. Gilbert Whyatt,
Borough Engineer and Surveyor.

Grimsby.
October 8, 1915.

To the Editor of The Surveyor.

Sir,—I observe in your issue of the 8th inst. that your contributor of "Things One Would Like to Know" draws attention to this very clumsy word, and asks if I could not introduce in my next "Glossary of Road Terms" a more euphonious and shorter word to express this unfavourable quality in a road surface. I do not think I mention this word in my Glossary, but I quite agree that the word is extremely clumsy and unattractive, and I fear that there is no English word that could at present take its place. That useful and learned work "Roget's Thesaurus" gives a number of correlative terms under the heading "Slippery," such as "greasy," "sebaceous," "butyraceous," "saponaceous," "pinguid," "lardaceous," which, with the exception of "greasy," are words that do not really meet the case, as I fear few of us would understand the expression "that the surface of a road was pinguid." The French are obliged to call it "qualité glissante," which is more elegant, but takes two words where one should suffice. The Imperial Dictionary only gives the word "imbricity," which is not helpful. The only word I can think of that might possibly meet the case is "slipperness," or even "slipness"; but perhaps some of your readers can invent a better word.—Yours, &c.,

H. Percy Boulnois.

34 Evelyn Mansions,
Westminster, S.W.

MRS. LILIAN BRADSHAW.

To the Editor of The Surveyor.

Sir,—Knowing the interest you have taken in the case of Mrs. Bradshaw, widow of the late Mr. F. E. G. Bradshaw, of Tamworth, I have pleasure to inform you that the committee of the Orphan Fund of the Institution of Municipal and County Engineers have granted Mrs. Bradshaw the sum of £15 for two quarters of the current year, with an understanding that her case will be reconsidered in December next in connection with a renewed grant for the ensuing year. A sum of £5 15s. 6d. has also been forwarded to Mrs. Bradshaw as special subscriptions to the fund on her behalf, thus making a total of £20 15s. 6d. contributed to her assistance through the institution's Orphan Fund.—Yours, &c.,

O. Claude Robson,
Hon. Secretary and Hon. Treasurer.

Municipal Offices,
Dyne-road,
Kilburn, N.W.
October 7, 1915.

CONCRETE MIXES.

To the Editor of The Surveyor.

Sir,—In co-operation with the Tests Standing Committee of the Concrete Institute (of which committee I am now a member), I intend doing some research on concrete mixes, and shall require some typical concrete aggregates—(1) granite, (2) sandstone, (3) ballast (gravel), (4) sand, and (5) cement.

My grant for this work is very much eaten into by the purchase of a concrete mixer and other apparatus, and I would therefore be grateful to any firms that would share the expense by supplying me with the above-mentioned materials.—Yours, &c.,

H. C. Johnson.

School of Engineering,
University College,
Cork.
October 8, 1915.

SCAVENGING: ADMINISTRATION *v.* CONTRACT.

To the Editor of The Surveyor.

Sir,—On September 24th your valued correspondent asked, under the heading "Things One Would Like to Know," "Why is it that there are still appearing advertisements asking for contracts for the removal of house refuse, emptying of middens, and so forth?"

The following is an excerpt from a comparatively recent report to my committee when discussing the question of "administrative" *v.* "contract" scavenging:—

"So long as the average man, horse and cart can readily be obtained at 7s. 6d. per day, or to undertake work at present contract prices, I feel satisfied that no cheaper system can be adopted."

Prices are now certainly up 12 per cent or 15 per cent, and will probably so remain even at the conclusion of the war; but in a rural district with large villages lying up to 15 miles apart, and varying up to 10 miles from headquarters, what can one do administratively as against reasonably priced tenders from experienced and proved contractors able and willing to carry out the work?

When the contrary is the case, well, the cost must of necessity be a secondary consideration, and the quality of the work, to say the least, will not suffer by the change; but it will undoubtedly add to the routine work of the surveyor and his office staff of one!—Yours, &c.,

Thomas Henry Negus,
District Surveyor,
Meriden Rural District Council.

Coleshill,
Birmingham.
October 7, 1915.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President Mr. H. T. Wakelam, M.Inst.C.E.,
County Engineer of Middlesex.
District Chairman Mr. J. P. Wakeford, M.Inst.C.E.,
City Engineer, Wakefield.

NORTH-EASTERN DISTRICT MEETING.

A North-Eastern District meeting will be held at Brighouse on Saturday, October 23rd.

Programme.

2.30 p.m.—Meet at the Municipal Buildings, Thornton-square.

Short paper on "The Duties of a Municipal Engineer in the Present War," by Mr. S. S. Haywood (member), borough engineer and surveyor, Brighouse.

Business:—

(1) Correspondence (if any).

(2) Minutes of last meeting held at Scarborough on Saturday, May 8th, 1915.

(3) Election of Executive Committee.

(4) To further consider the recommendation of the Executive Committee on the question of the reporting of District meetings.

(5) Any other business.

Inspection of aëration and filtration plant at the swimming baths.

p.m.—Tea, by kind invitation of Mr. S. S. Haywood, borough engineer and surveyor.

In order that the necessary arrangements may be made, the members must give notice of their intention to be present not later than Tuesday, October 19th.

F. O. Kirby, M.Sc., Assoc.M.Inst.C.E.,
Hon. District Secretary.

Doncaster.

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Limited. Price 10s. 6d.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. OCTOBER 22, 1915. No. 1,240.

Minutes of Proceedings.

Timbering Deep Trenches.

Having regard to the importance and difficulty of the work, it is certainly remarkable that writers of technical books have given so little attention to the timbering of deep excavations. The engineer, when he is confronted with most problems of construction, will find many excellent text-books ready to hand, but if the problem before him should be the timbering of deep excavations he will be surprised at the smallness and comparative uselessness of the information given. Though the design of great dams may be discussed, and though much may be said as to method of construction, it will generally be found that the writer has very little to say with regard to timbering the deep trenches which are often required. This is the more remarkable in that not only does the success of the whole work depend upon satisfactory support being given to the sides of such trenches, but the lives and safety of the workmen are equally dependent upon it. It must be confessed that the engineer is apt to leave such work almost entirely to the contractor. This practice, necessary as it may sometimes be under existing conditions, is, nevertheless, not wholly to be commended. If the timbering of deep trenches and excavations were considered and discussed more fully it would most certainly be useful. The subject is one well worthy of scientific consideration, and there is no very apparent reason why the work should be left to the contractor and to the rule-of-thumb worker.

The notes on methods of timbering for deep reservoir trenches, contained in an article recently published in the *Canadian Engineer*, entitled "Deep Trenches for Reservoirs," and written by Mr. J. M. M. Greig, are interesting, and the author makes a genuine effort to give practical information with regard to the timbering of certain very deep trenches, on which work he was actually engaged. The information, as far as it goes, is useful. The author's remarks, however, illustrate the prevailing practice, and he gives it as his opinion that "the engineer should never specify the form and size of timbering," and that it is even a mistake to say that the contractor shall submit drawings of his proposed method of timbering for approval. The argument is that the contractor takes the risk of accident, and should therefore have a free hand to do his work in a way of his own choosing. It is argued that if the engineer gives his approval of drawings for temporary work he then takes responsibility for them, and this is apparently considered unwise and unsafe. The reason for this state of things is not far to seek. The engineer who has not studied the science of timbering, and who has not the results of much similar work to refer to, cannot deal with the practical details of such work. As the author observes, there is very little enlightening literature on the subject of earth pressures—one has to rely upon trial and error; and were it not for the fact that the timber gives warning before it breaks, so that errors of judgment can be rectified, accidents would be more frequent. As it is the timbering is left to the contractor, and the contractor relies chiefly upon the experience of a practical timberman, upon whose shoulders the whole matter really rests.

Such a state of things ought not to be satisfactory to the engineer who likes to possess a perfect and certain knowledge of all work under his control. It is very undesirable, and points to the fact that more attention should be given to the subject. It is not suggested that the engineer whose experience in timbering deep excavations is limited should interfere with the contractor or timberman, but it is very desirable that the subject of earth pressures should be studied more fully, and that the safest, best, and most economical methods of supporting earth should be considered and discussed having regard to modern conditions and appliances. It is possible, for one thing, that much of the expense of ordinary timbering work could be saved if such investigations took place. The author measured the deflection of many of the planks in actual working while supporting earth, and then by loading similar planks with bricks, so as to produce the same deflection, obtained an idea of the force actually exerted by the earth.

* * *

Typhus in Serbia.

The lecture delivered by Dr. L. G. Moon under the auspices of the Chadwick Trust on Wednesday afternoon was the first of a series on "Typhus in Serbia," a specially appropriate subject in view of the awful ravages of this disease in former wars. The history of typhus fever exemplifies a great triumph of sanitary science, and may be regarded as one of the many indirect achievements of Chadwick and the men whom he influenced and inspired. Typhus was not definitely described till the middle of the eighteenth century, and though we are still ignorant of the cause of the disease, all analogy points to its being due to some micro-organism, and there is much evidence, though not conclusive, that the micro-organism is carried by lice.

Ignorance of the exact cause of the disease has not prevented it from being practically banished from the British Isles, owing to the great advances made in hygiene during the latter half of the nineteenth century. This is all the more striking as England, and particularly Ireland, were formerly the special habitat of typhus, which has now almost disappeared in these islands before the advance of sanitary science; hence in all countries where there is sound hygienic administration typhus loses its grip. Serbia, at the outbreak of the war, in all sanitary matters was entirely mediæval; consequently she fell an easy prey to the typhus epidemic, for all the conditions which favour the spread of typhus—namely, overcrowding, dirt, and lack of sufficient food—were present in Serbia after the victory over the Austrians last December. The addition of 67,000 Austrian prisoners put too great a strain upon the Serbian administrative machine, and the mortality among Serbian doctors had been so great that last July there were only 230 remaining out of an original 400. Fortunately by that time there were assembled in Serbia twelve British hospital units consisting of 420 British nurses and doctors, not to mention assistance from the United States, Russia, France, and Greece.

In the past the serious epidemics in Ireland have followed upon bad harvests and the potato famine, while the great epidemic in Upper Silesia of 1847 has owned a similar cause. Typhus has always been the grim accompaniment of wars, and was specially virulent after the battle of Austerlitz in 1805, and the following year after Jena and Auerstadt. The Grand Army of Napoleon was decimated by typhus while in Moscow and on the famous retreat. Nearly fifty years later so little had been learnt of hygiene that the ravages of typhus were almost as bad in the Crimean as in the wars of the first Napoleon, though the English army, which was less backward in this knowledge, did not suffer so much as the French. During the present war the armies of France and England, fighting in numbers which have never been equalled before, have remained entirely free from typhus. This great result we should attribute largely to the inspiration of Chadwick, whose arduous labours for public health were perhaps more recognised in France during his lifetime than in his own country. The second lecture of this course, which will be on "The Relation of Typhus to Plague, Relapsing Fever, and Enteric Fever," will be delivered on Friday next.

* * *

Local Authorities and Economy.

It will be remembered that in August last a circular letter was issued by the Local Government Board urging upon local authorities the present necessity for economy in the administration of the several public services for which they are responsible. This letter has now been under consideration for about two months, and many suggestions have been made and reports prepared as to the precise matters in regard to which such economy is possible. Among these reports, few have interested us more than that of Mr. A. R. Finch, the borough engineer of Kensington, which was considered at the last meeting of the council. In the first place, Mr. Finch emphasised the principle laid down by the President of the Local Government Board that the fact that reduction of expenditure may cause some inconvenience to the public can no longer be regarded as a reason for continuing that expenditure at its former level. The economies actually effected in Kensington by the application of this principle are illuminating. In the first place, some saving has been made by dispensing with the usual additional casual labour for sweeping up fallen leaves, while some £300 has also been saved by reduced street watering, which Mr. Finch regards as being "almost wholly a luxury." Further, there has been considerable reduction in the expenditure on street lighting by the substitution of one-light for two or three light burners at many points, and by the abolition of certain lights which appeared to be redundant. In connection with this service, the report calls attention to the wastefulness of shading down lamps to about one-fourth of their efficiency while full efficiency has to be paid for. If some means could be devised for a saving in the consumption of gas or electricity proportionate to the reduction in street lighting large sums might be saved in this and other boroughs. In Mr. Finch's opinion, however, it is in connection with the collection of house refuse that the most substantial saving might be made, if only householders could be educated up to burning all combustible waste. The suggestion is made that the council should refuse to remove such matters, and although the Works Committee did not feel able to accept this proposal, they did go so far as to authorise the town clerk to communicate with the Local Government Board urging the advisability of steps being taken by the board, by the introduction of a Bill into Parliament or otherwise, to obviate local authorities being required to incur expenditure in removing such materials as clean paper and cardboard, which can easily be burned by householders. We shall await developments with great interest.

* * *

Qualifications of an Engineer.

The Institution of Civil Engineers have recently issued a voluminous "tract" indicating "the course which should be contemplated by any person who intends to prepare himself for entrance into the Institution of Civil Engineers, and for the recognition of professional training and competence afforded by its diploma." At first sight this document might tend to frighten any young man who "contemplated" entering the profession of a civil engineer, but as the schedules of subjects are divided into eight groups of the branches of civil engineering, it is perhaps not so formidable as it looks. These groups are divided into the following heads: (1) Railways; (2) harbours, docks, rivers, and canals; (3) waterworks and sewerage; (4) municipal; (5) mechanical; (6) electrical; (7) mining; (8) gas works. Under the head of municipal the following subheadings are given: Designing and draining, estimating, specifying, taking out quantities, structural calculations for iron and steel work, masonry, brickwork, concrete, timber, and earthwork, surveying by chain and theodolite, levelling, Parliamentary surveys and plans, gauging rivers and streams, meteorological observations, borings and trial pits, testing and inspection of materials, the setting out and construction of excavations, earthworks, roads and streets, culverts, embankments, retaining walls, tunnels, bridges, conduits, pipe networks, sewers, sewage purification works, outfall works, refuse destructors, tramways, domestic drainage, public buildings; fire prevention and appliances therefor.

This is a very comprehensive list, and has been thoughtfully arranged. The schedules from which it is taken are intended to be marked and certified by the engineer to show the classes of work in which the student (or pupil) has had experience under him, and it is stated that acquaintance with some portion of these subjects is required when a certificate is given by the engineer under whose charge the student has studied. This is an excellent idea, and the institution is to be congratulated upon the issue of this important document, which is an admirable summary of what the training of an engineer should be in modern times. It should be a step towards the elucidation of a matter that has for some time past exercised the minds of engineers and others—namely, as to how the engineer should be trained and what he ought to know.

Bituminous Road Construction.

The problem of the prevention of the corrugation of asphaltic road surfaces has been approached hitherto principally from the point of view of weak foundations and the effect of heavy traffic. No doubt each of these factors is in a measure responsible for the evil complained of. On the other hand, much can be done towards its prevention by careful workmanship, together with the use of the most suitable materials in the laying of the bituminous carpet itself. Mr. E. J. Lovegrove, M.INST.C.E., the borough engineer and surveyor of Hornsey, whose admirable experimental work in connection with the science of road construction is so widely appreciated, some years ago carried out experiments with a view to finding in Nature an aggregate of single or mixed materials which, with Portland cement as a binder under hydraulic pressure, would produce better results than what is commonly known as the clinker slab, but he found that the use of clinker for this purpose was thoroughly justified. Now, by further experiments, some account of which will be found in another column, he has shown that for a bituminous or asphaltic carpet, when ordinary house refuse destructor clinker has been pulverised, the portion passing through a suitable fine revolving screen possesses such a natural grading and type of particle, both in shape and absorbent qualities, as to produce with a bitumen matrix a close-grained, tough, and wear-resisting surface. The argument based upon the results of these experiments is strengthened by the fact that clinker ground in the manner indicated has a strong resemblance to the grains of the aggregate in natural rock asphalt, which are irregular and ragged in shape so as to interlock, and also of such grades that the voids are filled by particles which in size approximate to the descending sizes of the voids themselves. A similar consideration shows that where sand is used the best results will be obtained by the blending of selected sands, the resultant grading of which will produce descending sizes of particles which will adapt themselves to the principle of more perfectly filling the descending sizes of voids. The published results of Mr. Lovegrove's experiments will be read with interest and appreciation.

* * *

Security of Tenure.

We gather from an article which appeared recently in our contemporary the *Contract Record* that the question of security of tenure for municipal engineers is even more pressing in Canada than is the case here at home. The article in question is based upon a suggestion made by the city engineer of New Westminster that civic officials should take out insurance policies against the possibility of the loss of an appointment through the arbitrary action of the municipal authority. It is stated that this proposition has been discussed for a long time in Great Britain, and that a company has been formed to accept risks of this class. This may be so, although we were not aware of the fact; but even if it is possible to insure against loss of office, this does not meet the grievance of insecurity. In the first place, it may be asked, why should an official be obliged to expend part of a salary which is in many cases only too meagre already in insuring against the infliction upon himself of what is, *ex hypothesi*, an injustice? Surely the full solution of the problem demands the removal of the injustice by taking out of the hands of the local authorities the arbitrary power they possess at present of removing an official without reason assigned. Quite recently a correspondent was seeking information from our Law Editor as to his rights in view of a threat on the part of his council to reduce his salary as surveyor, and the reply had to be given that, under the Public Health Act, with the exception of the medical officer of health and the sanitary inspector, every official is removable by an urban authority at their pleasure. We have always taken the view that the surveyor who conscientiously discharges his duties in connection with the supervision of sanitary and building work is peculiarly liable to fall foul of individual members of his council and to become the victim of spite. He is therefore as much entitled as the medical officer of health and sanitary inspector to such security of tenure as would render impossible his dismissal without the sanction of some independent authority such as the Local Government Board.

* * *

The Coventry Housing Scheme.

The remarkable industrial progress made by Coventry is disclosed indirectly in a report of the Housing Committee which was adopted at a recent special meeting of the city council. The cycle, motor, and munitions industries have been largely responsible for this development, and though an extraordinary output of munitions has temporarily added largely to the volume of local business, it appears that when this has ceased to be necessary the staple engineering trades of the city will continue to make progressive demands upon either private enterprise or the municipal authorities for the provision of house accommodation. The scheme adopted recently has for its object the erection of no fewer than 600 houses for munition workers on land near Stoke Heath, an area outside the city boundaries. The cost is estimated at from £150,000 to £200,000, and an arrangement has been made with the Ministry of Munitions by which the latter will pay the corporation about 20 per cent on what such a scheme would have cost at pre-war prices. The houses are to be, in the first instance, for munition workers, and would be held by the city council in the usual way, but the Housing Committee recognised that there must be quicker methods of erection than ordinarily prevail, and that financial assistance must come from the Government. Wisely, as we think, an alternative of temporary accommodation was rejected, on the ground of ultimate waste, and also, as the chairman of the Housing Committee put it, the confident expectation that Coventry is destined to be a much more important armament centre than it has been hitherto. It is a great undertaking to which the Coventry City Council has energetically set its hand, and as it is to be the precursor of further expansion it is to be hoped that its success will be merited by the enterprising policy that has dictated it as well as by the enlightened lines upon which it will be carried out.

Sewage Farm Crops at Burgess Hill.—It was reported recently to the Burgess Hill Urban District Council that the sale of crops of the sewage farm grown during the present year realised £200, and that there remained for sale crops estimated to produce about £190. Mr. Nye, chairman of the Sewage Farm Committee, said that they would see from the estimate that the crops would realise about £390, and they would receive for a part of last year's crops about £50, making a total estimate of receipts of £440. The receipts in past years had been, on an average, about £200, so that there was an increase of nearly 100 per cent. This pleasing result was mainly due to the construction of the new filter-beds, which permitted the farm to be worked to much greater advantage, and justified the committee's action in constructing the beds. The repayment of the principal and interest of the cost of the beds was more than covered by the increase of the receipts—indeed, it left a considerable margin—and, in addition to this most satisfactory financial result, they had an excellent sanitary result. The wheat grown averaged fourteen sacks to the acre, one portion realising sixteen, while oats realised twenty sacks to the acre. He thought the surveyor, Mr. Edwin Browne, was to be congratulated on the management of the farm.

Aggregates and Fillers for Bituminous Road Construction.

By E. J. LOVEGROVE, M.INST.C.E., Borough Engineer and Surveyor of Hornsey.

In connection with the recent discussions on the corrugating of asphaltic surfaces, much has been said with regard to road foundations and the effect of traffic; but there is, it is suggested, a factor of very great importance to the carrying out of the work so as to obtain an even surface, and to reduce to a minimum subsequent corrugation under traffic compression—namely, the character and gauge of the aggregate and filler used in manufacturing the material.

It may be generally accepted that in order to obtain a tough wear-resisting asphaltic surface coat the aggregate should be fairly fine; hence the recent use of different classes of sands together with a filler.

In some of the well-known examples of work a commonly used aggregate has been a mixture of two classes of sands and a Portland cement or other fine filler.

The grains of quartz (silica) which make up the bulk of any sand employed as an aggregate may exist in an angular, sub-angular or rounded condition. Most of the sands available for road construction are composed of grains in all these conditions; those with a higher proportion of angular grains being the sharper.

Owing to the very large proportion of quartz or silica grains in sands, the absorbent properties of a sand aggregate are extremely small, so that the bituminous matrix becomes merely a filler of the voids between the particles of sand.

Sands composed of quartz grains having a surface as rough and angular as those shown in Fig. 4, Minera, or Fig. 3, India, are comparatively rare; obviously such grains would knit together better in the matrix and hold more firmly to it than such smoothed and rounded grains as are shown in Fig. 14, desert sand; but they would absorb no more of the matrix. Ordinary sands lie between these extremes of angularity and roundness.

In result, if the grading is not very carefully adjusted, these particles are, in greater or lesser degree, not stable in the matrix. They are liable to move in the first rolling of the material, and also under subsequent traffic, the extent of movement being limited by the viscosity of the bitumen and filler matrix.

Portland cement as a binder under hydraulic pressure, would produce better results than what is commonly known as the clinker slab; but it was found that for such a class of work the use of clinker as an aggregate was difficult to improve upon on account of its tough, well-graded and binding qualities.

The same principle may be applied in degree to a bituminous or asphaltic carpet. Ordinary house-refuse destructor clinker, having been pulverised, the portion passing through a suitable fine revolving screen possesses a natural grading and type of particle, both in its shape and absorbent qualities, which produces with a bitumen matrix a close-grained, tough and wear-resisting surface.

It is suggested that, in order to ascertain the value of a material as an aggregate, the comparison of photomicrographs of a certain gauge should be a guide as to the shape factor of the parent material, and to illustrate this, siftings of several materials have been taken representing the particles which passed through a 76-mesh sieve, and from which have been removed the finer particles passing through a 100-mesh sieve.

With the courteous assistance of Mr. J. Allen Howe and Dr. H. H. Thomas, of the Geological Survey and Museum, Jermyn-street, S.W., I am able to reproduce photomicrographs and descriptions of these materials (see inset plate).

As regards the shape factor, it is obvious that the clinkers take the first place, the particles showing irregular shapes and ragged edges, the nearest approach to these qualities in the sands being the Minera, Indian flexible sandstone, and crushed quartz.

The advantage of pulverising the clinker in a high-speed machine instead of mill grinding is emphasised as producing an aggregate of far higher value.

The pulverised material is excellent in respect of the shape and ragged edges of its particles and generally of good grading, subject to the removal, in some instances, of part of the fine powder by fan draught, whereas the mill-ground material is not so well graded, and the particles may be described as ranging from rounded to sub-angular.

The following gradings of sifted, pulverised clinkers and sands may be of interest:

Grading of Clinkers Pulverised under Similar Conditions which have Passed ½ in. Square Mesh Revolving Screen and Coarse, Medium and Fine Sands.

No.	Passed sieve	Retained on sieve.	Percentages by weight.				
			Destructor clinker.	Gas works clinker.	Reigate sand.	Aylesford sand.	Erith loam.
1	½ in.	10 × 10	12·11	11·09		—	—
2	10 × 10	20 × 20	22·50	38·51	2·00	—	—
3	20 × 20	30 × 30	13·04	11·95	7·50	—	·50
4	30 × 30	40 × 40	4·84	10·79	35·00	·25	·50
5	40 × 40	50 × 50	8·12	3·91	19·50	·75	·50
6	50 × 50	76 × 76	3·75	6·87	27·00	35·00	1·00
7	76 × 76	100 × 100	4·80	4·14	3·50	58·00	10·00
8	100 × 100	200 × 200	11·41	3·83	3·00	5·75	80·50
9	200 × 200	—	17·43	8·01	2·50	·25	7·00
—	—	—	100·	100·	100·	100·	100·

Until recent years the best-known asphalt road, which has given very excellent results in wear, has been the natural rock asphalt laid hot in a powdered condition, and compressed in situ.

If a high-class asphaltic rock be examined it will be found that the limestone has absorbed the bitumen and the mass is close textured and practically free from voids.

It therefore appears that excellence of resistance to wear is to be found in a material which is akin to natural rock asphalt, and in which the grains of the aggregate are of such grades that the voids are filled by particles which in size approximate to the descending sizes of the voids themselves.

The writer, in carrying out experiments some years ago, endeavoured to find a natural aggregate of single or mixed materials, such as rock or sand, which, with

The gradings of the sands point to the high results that may be obtained by the blending of selected sands, the resultant grading of which will produce descending sizes of particles to carry out the principle of more perfectly filling the descending sizes of voids.

The character of the filler appears to be of the highest importance, whether used in the preparation of the wearing surface coat or in the preparation of grouting for macadam.

The particles should be extremely fine, absorbent and tough, so that a perfect incorporation with, and suspension in, the bitumen is obtained.

With such a filler the matrix becomes a wear-resisting material as well as a binder, retaining its viscosity under summer heat.

Attention is particularly drawn to the impal-

paste powder passing a 200-mesh sieve in the trade grading, forming a naturally produced filler as the process of pulverising the particles having the same tough and wear-resisting qualities as the parent material.

The object of these remarks is not to place in respect of suitability any one class of aggregate mentioned before another, as all work must necessarily be controlled by local conditions and possibility of obtaining material at a workable price. The intent is rather to urge the need of careful selection and grading of the aggregate.

CORRESPONDENCE.

ἐκ δυοῖν οὐ πάντ' ἀρᾷ
(One man does not see everything.)
— EURIPIDES.

GLASGOW SCAVENGING.

To the Editor of THE SURVEYOR.

SIR,—I have read with interest the further remarks in connection with this subject appearing in your issue of the 8th inst.

The theory that revenue should be totally ignored is, in my opinion, in this particular case at all events, a fallacy. A scrutiny of the two sides of the account will at once justify this assertion. Take, for instance, one item of revenue—the payment by the Clyde Trustees for cleansing and watering the wharves (£6,554). This is practically wholly expended in labour, horse hire, and railway carriage on behalf of the said trustees. As there is a business arrangement between the corporation and the Clyde Trustees to do the work for payment, clearly we are not entitled to debit Glasgow cleansing with the cost of harbour cleansing.

The same argument applies all round; so that the nett cost (not the gross) is the real cost to the citizens of Glasgow.

I had thought from your contributor's first communication that he had my annual report before him, but in case I may be mistaken in this I now send you a copy herewith, together with a copy of "A Résumé of Glasgow Cleansing," prepared by my predecessor, Mr. D. McColl.

Should your contributor desire any further information than what is contained in the foregoing publications, would he care to write me direct?—Yours, &c.,

W. GREIG,
Superintendent.

Cleansing Department,
Glasgow.
October 12, 1915.

[We have submitted Mr. Greig's letter to our correspondent, who has replied as follows.—Ed. SURVEYOR.]

To the Editor of THE SURVEYOR.

SIR,—I am obliged to you for giving me an opportunity of referring to Mr. Greig's letter. I am also extremely obliged to Mr. Greig for his letter and further explanation, and for the reports which accompanied it.

When I drew attention to the apparently heavy cost of scavenging in Glasgow in my paragraph in "Things One Would Like to Know" I had not had the advantage of seeing the balance-sheet, and took my figures from an account in a Glasgow newspaper.

I am now able to dissect the figures, which appear to be as follows:—

The gross cost of scavenging for the year ended May 31, 1915, was £198,571; but there appear to be a number of items that I think in fairness should be omitted—such as repayment of loan debt, interest on loans, war bonuses to employees, and allowances to those who have joined H.M. Forces, special compensation, and a few small items making altogether a sum of £24,034, thus reducing the gross expenditure to £174,537. The total amount of refuse collected and disposed of appears to have amounted to 416,276 tons, which gives about 8s. 4½d. a ton instead of the 9s. I originally stated. My contention has been hitherto that this represents the actual cost of scavenging, but it now appears that in the revenue account there are certain items which might fairly be deducted from the apparent gross cost as they are payments for services rendered outside the work of town scavenging. It is somewhat difficult to dissect these items, but I think the sum of £12,308 would fairly represent this work. This further reduces the gross cost to £162,229, which makes the cost of collection, &c., about 7s. 9d. per ton, instead of the 9s. I gave in the first case. If Mr. Greig takes credit for all the revenue, amounting to £44,350, then deducting this from £174,537 leaves £130,187, or a cost of about 6s. 3d. a ton.

However, I still maintain that deducting revenue does not assist one in obtaining the cost of any work; otherwise a farmer might deduct the revenue he obtained from the produce he sold at market from the cost of getting it there, and the result would not help him in checking his expenditure; though I agree if his profits were large he would be contented to leave things as they were. If, however, his revenue was small compared to his expenditure, he could only check that expenditure by finding out what was the gross cost.

I am much obliged to Mr. Greig for his offer to communicate with me direct, and some day I may ask him to do so; but in the meantime I prefer to subscribe myself as heretofore.—Yours, &c.,

YOUR CONTRIBUTOR.

October 18, 1915.

TARMAC.

To the Editor of THE SURVEYOR.

SIR,—In your issue of October 15th, p. 422, there is a paragraph stating that "J. A." writes: "Will surveyors who have laid tarmac having an aggregate of Guernsey or other hard granite kindly state whether they have found its wearing capacity equal or superior to that of tarmac composed of a softer stone, such as slag or limestone?"

Will you allow us space to inform your correspondent that the word "Tarmac" is our registered trade mark, and should only be used to describe this company's material?

"Tarmac" is made by this company only, of specially selected blast-furnace slag treated with the company's own preparation of refined tar and other ingredients under our patent process.

If your correspondent will write us direct we shall be glad to give him information as to where he could inspect lengths of "Tarmac" laid end-on to lengths of other tar-bound materials.—Yours, &c.,

For Tarmac, Limited,

D. G. COMYN,
Manager and Secretary.

Ettingshall,
Wolverhampton.
October 19, 1915.

DEPLETION OF PRIVATE WELL SUPPLIES.

STAINES RURAL COUNCIL'S COMPLAINT.

At last Friday's meeting of the Metropolitan Water Board the Works and Stores Committee reported that complaints had been received from the Staines Rural District Council, the Laleham Parish Council, and owners and residents in the immediate neighbourhood of the Littleton reservoir works of the depletion of private well supplies by the pumping operations of the board's contractors.

The committee pointed out that when the board's New Works Act of 1911 was being considered by the Joint Committee of Parliament, the late chief engineer, Mr. Bryan, when giving evidence, engaged that the board would take steps to provide a supply of water if the wells in the neighbourhood of the Littleton works became depleted to such an extent as to render a supply therefrom unavailable. As at present advised the committee were not satisfied that circumstances would arise under which it would become necessary to fulfil the late chief engineer's undertaking to Parliament. The Staines Rural District Council, however, represented that they were under considerable apprehension in the matter, as if the local wells became seriously depleted it might be necessary for them to arrange with the South-West Suburban Water Company for the laying of mains to afford a supply of the company's water. In that event the water rates derived from the property would not amount to as much as the guarantee of 10 per cent on their outlay to which the water company would be entitled under the Waterworks Clauses Act, 1847. The committee had therefore arranged with the rural district council that the board would undertake to pay a moiety of any such deficiency not exceeding £50 in any one year for a period of five years.

Water Supply in Nuneaton Rural District.*

By R. C. MOON, Assoc.M.Inst.C.E., Acting Borough Engineer of Nuneaton.

The water supply scheme described and illustrated in this article was inaugurated by the Nuneaton Rural District Council to supply a population of some 2,500 persons in part of the parish of Arley.

Formerly the site of a Roman camp, of which remains are still in existence, Arley has rapidly grown in population during recent times owing to the successful operations which have been conducted in search of coal.

The works include a water tower and a covered service reservoir, both constructed in Mouchel-Hennebique.

The supply of water is derived from the shafts of the Arley Colliery Company, being pumped by the company from a depth of 1,000 ft. below ground level and lifted a further height of 185 ft. to the water tower and service reservoir, both situated on high ground about 2,000 yds. from the pit mouth.

The water is raised by means of a 6-stage high-lift turbine pump, coupled direct to an electric motor, and capable of discharging 24,000 gallons of water per hour through a 6-in. diameter rising main in the colliery shaft. Connected with this main, a pumping main is laid from the colliery to the water tower, into which the water is delivered in the first instance and overflows into the service reservoir close at hand.

Fig. 1.—View of Arley Water Tower.

The water tower has a storage capacity of 5,000 gallons, and is used for the supply of a small high-level part of the district. The service reservoir has a capacity of 50,000 gallons, and supplies the low-level district of the parish. The pumping main is also used on part of its length as a distributing main, and is tapped for house services and fire hydrants. Other mains have been laid from the water tower and service reservoir to the total length of 4,070 yds.

Both the tower and the service reservoir were constructed in ferro-concrete from the designs of Captain F. C. Cook, R.E., Assoc.M.Inst.C.E., the borough engineer of Nuneaton, as engineer responsible for the entire scheme, and whose previous experience had convinced him of the special advantages of this form of construction for a district liable to subsidences in consequence of mining operations. The contractors were Messrs. Lambrick & Co., of Burton-on-Trent, and the working drawings for the ferro-concrete structures were prepared by Messrs. L. G. Mouchel & Partners, Limited, of Westminster. In passing, it is interesting to note that Captain Cook is at the present time away on military duty, having been granted leave of absence by the Nuneaton Corporation for the period of the war.

Fig. 2 includes a selection of drawings illustrating the construction of the water tower. The reservoir measures 13 ft. 5 in. square by 4 ft. 8 in. inside, the bottom being 5 in. thick, the walls 7 in. thick, and the roof 4 in. thick. The section to enlarged scale shows the arrangement of the reinforcing bars and the knee braces which occur at all angles. The supporting tower is 15 ft. high above foundation level, and consists of four columns 12 in. square, reinforced as shown in the lower part of the enlarged detail; in addition to these columns being horizontal and diagonal bracing on each side, the reinforcement of the bracing members being made clear by the half vertical section. As customary in Mouchel-Hennebique practice, the construction is monolithic throughout, this feature, as well as the effective disposition of the reinforcement, rendering the structure extremely rigid and capable of acting as a single unit in case of settlement of the ground, a point of great importance in a district where colliery workings have caused serious injury to reservoirs of ordinary design and construction.

The covered service reservoir, constructed partly below ground level and banked up with earth, is illustrated in Fig. 3. The reservoir measures 32 ft. square by 9 ft. 6 in. high inside, the bottom and sides being 5 in. thick and the roof 3½ in. thick; the sides are stiffened by counterforts at intervals of 10 ft. 6 in. apart, centre to centre. The majority of the counterforts measure 6 in. by 12 in. in cross-section, those at the corners are 6 in. by 18 in., and two in line with the interior columns measure 10 in. by 12 in., enabling them to act as exterior columns carrying the outer ends of the main beam in the roof system. The interior columns are 10 in. square, and the main beam is 8 in. wide by 16 in. deep, the secondary beams measuring 6 in. wide by 14 in. deep. As shown at the left-hand of the section, a manhole is provided for access purposes, and all necessary facilities are included for inlet, outlet, overflow and washout pipes. The manhole frame is flanged so as to permit the top of the reservoir to be covered by earth to a depth of 18 in., as a protection against extremes of heat and cold.

* From *Ferro-Concrete* for October.

Halifax Water Supply.—The leakage of water from the Walshaw Dean reservoirs, which has occupied the attention of engineering experts for the past eight years, has now been successfully coped with, and all the water entering the catchment area is secured for consumption, with the result that Halifax is in the position of having available, even in time of severe drought, a supply of 1,440,000 gallons a day as compensation water, and 2,500,000 for the use of ratepayers from that source alone. The protective works, which were carried out by Messrs. G. H. Hill & Son, of Manchester, were formally inaugurated recently by the mayor and corporation. The cost has amounted to £20,000, bringing the total expenditure on the reservoirs to some £380,000.

THE WAR AND WORKSHOP PLANT.

In his presidential address to the members of the Association of Engineers-in-Charge last week, Mr. Frank Bailey, M.INST.C.E., observed that it was certain that as England was now one huge arsenal, the experience gained by repetition work, the use of high-speed tool steel, and the necessity for securing great accuracy, would result in a general improvement in the ordinary workshop methods. The design of modern machine tools, with their stiffer construction, convenient change speed gear, and many improvements, would compel all users of workshop plant seriously to consider the economy of scrapping their old tools. Engineers-in-charge would doubtless take a prominent part in such a change, and they would also, perhaps, realise that mechanical work of all kinds would be improved in accuracy and rapidity of output. Long after the termination of the present war the practical effect of the lessons taught by hard experience would be evident in the industry of the nation; and, in view of the heavier financial charges they would all have to bear, it was some consolation to know that there was not only room for improvement in many of our present methods of manufacture, but that the means of securing this improvement were now available.

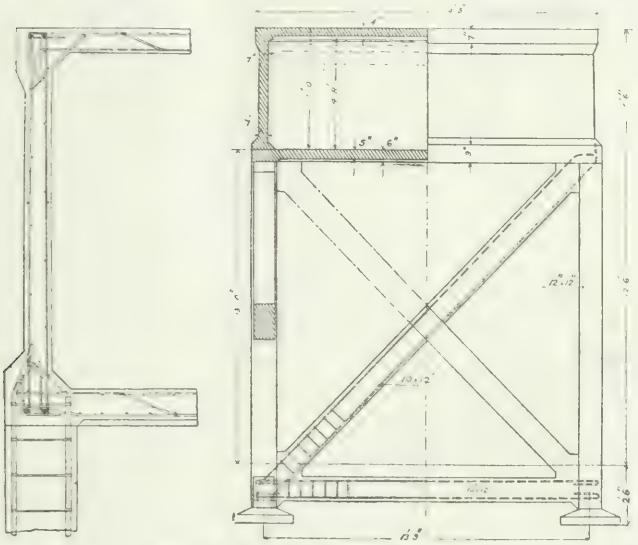


Fig. 2. Details of Water Tower

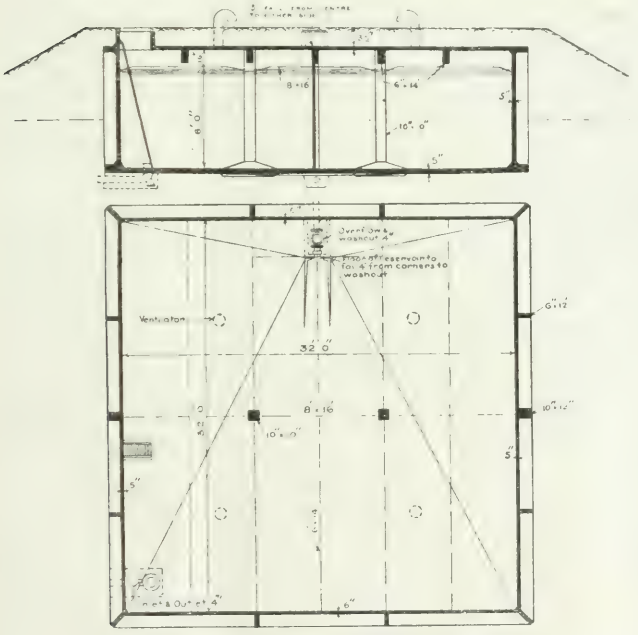


Fig. 3. Plan and Section of Service Reservoir.

Swansea Bridge Opening.—A new bridge connecting Victoria Park, Swansea, with the sands, and obviating the use of a dangerous crossing, was opened last week. A ferro-concrete structure was first contemplated, but in consequence of the attitude of a Local Government Board inspector at the inquiry the idea was dropped in favour of a steel bridge, and Mr. H. Howard Humphreys, M.INST.C.E., Westminster, was selected engineer, and submitted designs and estimates in October, 1913. In May, 1914, tenders were accepted for: Ironwork, Messrs. Rees & Kirby, Morriston, £1,258; and stonework, Messrs. Muirhead & Co., London, £3,199; a total of £4,457. The contract time for completion was May 17th last. The season just ended appears to have been a record for the sands, and if on the completion of the war the town's progress is maintained it is hoped to proceed with the erection of a pavilion on the site of the present flower garden, and to extend the bridge so that it will become a pier.

Motor Fire Engine for Exmouth. The public test of Exmouth's new motor fire engine took place last Saturday in the presence of members of the council and a large number of townspeople. With a single jet, using a 1¼-in. nozzle, a pressure of 180 lb. per square inch was secured, and a similar pressure was obtained with two ¾-in. jets. Four jets were also shown in operation, the whole of the work being pronounced most satisfactory. Subsequently a 30-mile trip was taken, the route followed being up the Budleigh Salterton road, across Woodbury Common to Woodbury Village, then to Clyst St. George, and back to Exmouth by the Exeter main road. A feature of the run was the ease with which the engine started with its load against the steep incline at the foot of Carlton-hill, while the brake test, applied when going down Knowle-hill, proved satisfactory in the highest degree. The new engine is of the Merryweather petrol "Hatfield" design, with a pumping capacity of 350 to 400 gallons per minute. A speed of between 30 and 40 miles an hour can be attained on the level. Towing hooks are provided for drawing the existing horsed steamer, which has been in service for the past nine years. Motor fire engines of the same design are also in service at Exeter and Devonport.

Road Construction and Maintenance in Johannesburg.*

By G. S. BURT ANDREWS, M.Inst.C.E.

Like all other important centres, Johannesburg is alive to the necessity of good roads, and no effort has been spared to bring about the best results with the material and funds available. After a careful study of the conditions in other places, it would appear that Johannesburg suffers many disadvantages which are not so apparent in all cases elsewhere. Some of the disadvantages are :-

(1) Excessive area and length of roads as compared with the building plots and population;
(2) Difficulty of obtaining suitable material at a reasonable cost;
(3) Climatic conditions and traffic;
(4) Method of obtaining funds;
(5) Absence of regulations dealing with the development of townships; and
(6) The extraordinarily rapid growth of the town.

STATISTICS.

The area of the municipality is 81·75 square miles, of which 39·8 per cent is laid out as townships, 20·8 per cent is mining ground, and 39·4 per cent is agricultural land, plantations, bare veldt, &c.

The total length of roads is 775·4 miles. They vary in width from 124 ft. to 41 ft., the average being about 59 ft. From this it will be seen that the street area is no less than 26·6 per cent of the total area of the townships. In some instances the percentage of street area goes as high as 42·22 per cent. Apart from any other drawbacks, this is a particularly heavy burden for any community to have to face.

The population at the last census in 1911 was 248,875.

ROAD MATERIAL.

Although there are numerous outcrops of rock in the municipal area, very little of it is suitable for road making. It consists principally of sandstone, shale and quartzite. Outcrops of granite occur a few miles to the north and diabase to the south, but, owing to the heavy cost, the idea of going further afield for stone had to be abandoned. About eleven years ago arrangements were made for the supply of diabase from the council's sewage farm at Klipspruit. After a fair trial, however, it was found that the stone, although very hard and tough, was not suitable for macadam, as it came away from the crusher in flat and conchoidal pieces instead of breaking in the form of a cube. The cost per ton of 2,000 lb. of 2½-in. stone worked out as follows: Quarrying, breaking, and delivery on trucks (1,300 yds. from quarry to siding), 5s.; railway terminal charges, 4d.; railage (11 miles), 1s. 2d.; value of stone at quarry 6d.; total, 7s., exclusive of cartage from station to roads. One ton of 2½-in. diabase is equal to 21·249 cub. ft., and the specific gravity is 2·84. A few years later a site was obtained for a granite quarry on the Houghton estate, near Orange-grove, which is about 4 miles by road from the centre of the town. The granite is of fair quality, and breaks to a fairly good shape, but, unfortunately, the development charges were heavy owing to the large quantity of overburden and irregular formation. Ultimately the quarry was closed down, partly on account of the cost of quarrying and transport and partly because of objections raised by residents to the noise caused by blasting and the close proximity of a camp of natives. The cost per ton of 2,000 lb. of 2½-in. stone for quarrying and breaking was 4s. 6d. per cubic yard, exclusive of development charges. The specific gravity is 2·71, and 1 ton of 2½-in. granite is equal to 22·268 cub. ft. Although only 4 miles from the centre of the town, the cost of transport was high, on account of the heavy pull from the quarry to the centre of the town.

With the exception of the experiments made with diabase and granite all the stone used for road making is waste rock from mines, locally known as "blue bar." For some years it was difficult to obtain minestone of even quality, as the rock taken from near the surface was much softer than that taken from the lower levels, and as it was all dumped on the same heap it could hardly be expected that the roads would wear evenly. Now that practically all the rock comes from the deep levels this disadvantage is not quite so noticeable. Even so, it cannot be said that waste rock from the mines is a suitable material for making roads. It stands fairly well on suburban roads when the surface is coated with tar and other similar material, but it soon goes to pieces in busy thoroughfares. The only thing in its favour is its cheapness, and it is fortunate for Johannesburg that it is so; otherwise the rate would obviously be much higher than it is, or there would be fewer roads constructed. In remetalling a road the difference between minestone or granite becomes very apparent; in the former case very few stones of any size are left, whereas in the latter the stones below the worn surface are still in existence. It is thought that this rapid disintegration of the stone is due, in some measure, to the high explosives used in the mines.

The cost of 2½-in. minestone per ton of 2,000 lb. works out at about 1s. 7d. delivered into carts. This is the price paid to contractors at 1s. per load of 17 cub. ft. At the municipal breakers the stone costs about 10½d. per load of 17 cub. ft., or about 1s. 5d. per short ton. The specific gravity is 2·70, and 1 ton of 2½-in. minestone is equal to 22·88 cub. ft. As the mines adjoin the urban area the cost of transport is not excessive; but this will be dealt with later.

RAINFALL AND TRAFFIC.

Before the advent of tar-coating considerably more damage was done to macadamised roads in the suburbs by rain and wind than by traffic. Rainfalls with an intensity of over 4 in. per hour are very trying to a macadamised road, especially on hilly ground, and where no gutters or underground drains have been provided. Before the rainy season commences it is customary to get several weeks of windy weather, which leaves an uncoated road not unlike rough mosaic with open joints. The coating of roads with tar or other similar material has lessened the cost of maintenance considerably.

About five years ago the amount of traffic in some of the busy thoroughfares between the hours of 7 a.m. and 6 p.m. was noted and recorded. . . . These observations give some idea of the traffic on the main thoroughfares in the busiest part of the town, and show the necessity for adopting a more suitable material than minestone for the central area. A good deal of damage is done to many of our roadways by motor lorries and traction engines belonging to the railway administration; this traffic, however, is limited to a certain number of streets.

FUNDS AVAILABLE.

In pre-war days the roads in Johannesburg were constructed partly out of grants made by Government and partly out of revenue from rates. Soon after the war a large loan was raised, and a portion (£343,000) was allocated to road construction. This money is now nearly exhausted, and approximately 186·34 miles of roadway have been made out of a total of 775·4 miles. The English practice is preferable in every way. There only main roads and the maintenance of roads can be debited to revenue out of rates, the first cost—including sewering, paving, kerbing, guttering and lighting—being a charge on the abutting owners (see sec. 150 of the Public Health Act of 1875). This system prevents irregular development of new townships, much log-rolling, and the constant clamouring for new roads. In England even the maintenance of main or trunk roads is not wholly chargeable to revenue, as a proportion is paid by the Government. This arrangement has to some extent been adopted here, but the contribution (£3,580 per annum) is very small for the 41 miles of trunk roads to be constructed and maintained. It is less than 1s. per lineal yard, or about one-twenty-seventh of the first cost, irrespective of upkeep. Owing to the war this contribution was suspended in January last, so that the whole cost has now to be taken out of municipal revenue. The question of funds for additional road construction is becoming a very serious problem for the municipal council to tackle.

There are 111 townships within the municipal area, some very sparsely populated, others with but a small percentage of vacant stands or lots. Some of the townships extend as far as the municipal boundary, a distance of nearly 6 miles in one case from the town hall. Most of the townships have ratepayers' associations, and their protestations on the subject of roads are in some cases loud and fre-

* From a paper read at a meeting of the South African Society of Civil Engineers.

extent. With few exceptions they all consider that insufficient attention is being given to their particular area, and as for the individual—well, his usual complaint is that he has paid his rates for so many years and nothing has been done to the road in front of his house, and, as a parting shot, "I ask you, Mr. Engineer, for what do I pay rates; surely it should be the first road to make." Many of the townships were laid out and passed by the Government before they came within the jurisdiction of the municipality, and in some cases little, if any, consideration appears to have been given to the suitability of positions for roads. In several places no outlets have been provided for drainage, and occasionally the crossfall is so great that it is practically impossible to make a road and give satisfactory access to the abutting properties. This careless way of laying out townships means considerable difficulty and enormous expense to a municipality like Johannesburg, where the landowners are not individually responsible for the first cost of making the roads in front of their properties.

RAPID GROWTH.

In addition to the difficulties already mentioned, one must not overlook the extraordinarily rapid growth of the town. Less than thirty years ago the ground on which Johannesburg is built was bare veldt, and it is little more than twenty years since road making was commenced in real earnest. Before 1901 the area of the municipality was only 5·1 square miles. In 1893 the total length of roads under the council's jurisdiction was 71·066 miles. This was increased in 1897 to 139 miles.

According to a statistical statement published by the municipality in 1906 the population of the town in 1887 is stated to have been about 3,000, and in January, 1890, 26,303. A census taken in July, 1896, showed a total population within a radius of 3 miles from the Market-square of 102,078, of whom 50,907 were Europeans. From the census taken in April, 1904, the population was 155,642.

(To be continued.)

Royal Institute of British Architects.—At a meeting of this body to be held on Monday, November 1st, Mr. Ernest Newton, R.A., will deliver the opening address of the session. In the course of the proceedings a portrait of Mr. Reginald Blomfield, R.A., past-president, will be unveiled and formally presented to the institute.

Economy at Kidderminster.—Kidderminster Town Council on Wednesday accepted an offer of the [illegible] company to light 379 lamps at £2 15s. per lamp per annum, the lights to be extinguished at 11 p.m. in [illegible] months. Alderman Jones said that by the reduced lighting the town would save £1,100 a year, and he hoped economies would be secured in other directions. The council approved a recommendation of the Parks Committee to reduce by one-fourth the staff of workmen in the park.

Town Planning.—This was the subject of a lecture delivered on the 13th inst. by Councillor George Cadbury, junr., under the auspices of the Birmingham and Midland Institute Scientific Society. The lecturer mentioned that there were 25,000 acres of undeveloped land in the city of Birmingham. In their efforts to improve the appearance of the city the Town Planning Committee had received the co-operation of the landlords; in fact, almost all the landowners in the area governed by the city council had lent their assistance in the promulgation of town-planning schemes. To open out the old town had been a most expensive undertaking. During the ten years previous to 1912 Birmingham spent £876,000 in street widening. It was impossible to proceed with the development of a city unless adequate road connection was available. The problems before the Town Planning Committee in 1911 were what to do with the undeveloped areas, and how to treat them in a practical and systematic manner. In addition to the four schemes undertaken within the city, there were three outside—those at Sutton Coldfield, Oldbury, and Rubery; so Birmingham was not alone in its efforts to beautify its districts. The lecturer described a proposal to make a road 100 ft. wide, on which the tramlines would be laid on one side and given a space of 34 ft. Thirty-five feet would be set apart for vehicular traffic, while the remainder would be allotted to footpaths. It was calculated that with a system of this kind a saving would be effected in the running of trams of an amount equivalent to ½d. per car-mile.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Why do the advisers of the Middlesex County Council object to the use of Tarmac in Kingsbury-road, notwithstanding the success of the trial length laid in 1912, as recently reported by the chairman of the urban district council? Having regard to the fact that Tarmac has stood the test of time and traffic nearly all over the country, would it not be interesting to know whether there is some special reason for the objection to its use on this road?

* * * *

Do we not hear on all sides increasing complaints of the great rise in prices of labour, team work, and materials for road purposes? Is it, however, at all likely that when this disastrous war is over prices will drop to their normal level?

* * * *

Apropos of the above, is it a fact, as stated in a daily paper the other day, that munition workers in this country are being paid wages which are sixteen times higher than those paid in Germany and twelve times higher than those paid in France? What is going to happen when the day of reckoning comes?

* * * *

Is there not a very salutary lesson to be learnt by many councillors who are prone to interfere directly with men in their employment on the roads and other public works by the recent report of what transpired at the St. Asaph, Flint, Rural District Council meeting? Was it not rather amazing to read that there had been so much interference of this description that the surveyor "had little or no authority over the men," and that "he was looked upon by some as a mere nobody"? Was it not to be expected that "it was eventually decided that the surveyor should again have full control over his men"? Was it not a pity that such a state of affairs should have been allowed to occur?

* * * *

Would it not be advisable for all good citizens to remain indoors whenever Zeppelins are on the "war-path"? Does not the presence of crowds of irresponsible persons in the streets seriously incommode the actions of the fire brigade and police and hamper their useful operations?

* * * *

Does not the recent issue of a circular by the Institution of Civil Engineers upon the training of engineers, with its 150 subjects which an engineer might be expected to have some acquaintance with, remind us of some great man's definition of a really clever man as "a man who knows something of everything and everything of something"? Would not any man who could know something of all the subjects enumerated in those schedules be a veritable walking encyclopædia of knowledge? Even with all this knowledge, would he be a *perfect* engineer unless he could also manage men? Was it not "Geordy" Stephenson who said it was more easy to engineer materials than it was to engineer men?

* * * *

Has not the council of the Institution of Municipal and County Engineers arrived at a sound conclusion by deciding that, if possible, slag shall be standardised, and asking members of the Standardisation Committee and of the Roads and Tramways Committee to consider the question individually, so as to be able to advise their respective committees at a subsequent date? Is it, however, possible to standardise this material as regards its specific gravity, porosity, hardness, toughness and other qualities, when it is known that slag varies considerably in nearly every locality and in almost every furnace?

* * * *

Was any definite decision arrived at on the discussion on road tarring, opened by Mr. Croome at the meeting at Cromer last August, as to whether flint roads could be successfully tarred? Would it not appear from what was said by many speakers that if the flints were crushed the result was more satisfactory; and would not this be likely to be the case, as the interstices would be better filled? Is it not a fact that for light traffic well-broken selected flints make very good roads, and that after sufficient vehicular wear the surface becomes in excellent condition to receive the tar?

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, assoc.m.inst.c.e.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

506. Concrete Sewer Construction.—Is it necessary to support concrete sewer tubes with concrete at the sides, the tubes being 21-in. diameter? If it depends on the depth below the street whether they should be supported by concrete or not, then what are the least and greatest depths at which they can be laid without concrete support at the sides? ("Polox.")

507. Design of Retaining Walls.—What are some good, practical rules for the design of (1) brick and (2) concrete (not reinforced) retaining walls to withstand earth pressure? ("Polox.")

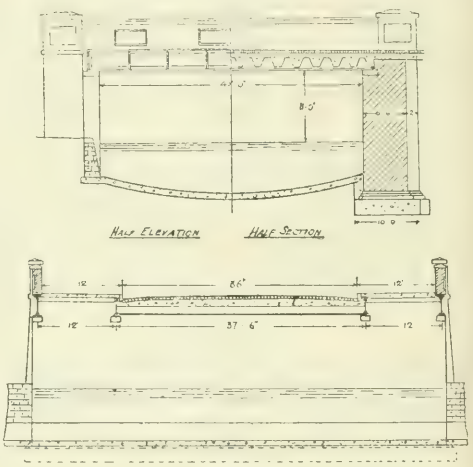
508. Street Construction.—Some new streets are to be laid out involving considerable cutting and filling of the ground. Longitudinal sections of the ground showing the levels of the new road have been prepared. The cutting and filling have to be measured up as the work proceeds. What is the best method of doing this? (Polox.)

509. Sewerage.—A 12-in. sewer, laid at a gradient of 1 in 50, has an average depth, dry-weather flow, of 1 in. How would you calculate the depth of six times the dry-weather flow? A leaping weir is fixed 12 in. below the outlet of the pipe. At what distance should the edge of the weir be fixed from the outlet of the pipe to take all above six times dry-weather flow? Give mathematical and graphical calculations. ("Pennbourne.")

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

504. Bridge Design.—A bridge is required to carry a 60-ft. street over a canal, the clear span being 40 ft., the minimum head room being 11 ft. at centre and 9 ft. at sides above normal water level. The approaches are rising gradients of 1 in 24 and 1 in 90 respectively. Sketch the bridge you recommend for such a position, giving all important particulars, short specification tests for materials, and tests for bridge when completed. (P. W., *Pontypridd.*)

The choice in the design of a bridge for this position is limited by the two facts (1) that there is so much headroom demanded by the canal company, and (2) the existence of a pretty steep gradient on one approach. An arch bridge, though probably more artistic and in better keeping with the surroundings, is out of the question, as it would greatly increase the gradient. To give the required headroom of 9 ft. at the sides the crown of the arch would of necessity for 40-ft. span be about 17 ft. above normal water level, and this would increase the gradient very considerably. Under the circumstances, the type of bridge illustrated would be suitable. The abutments are brickwork, and the parapets are brickwork with granite coping and dressings. The roadway and parapets are carried on four main plate girders 36 in. deep over the angle irons, resting on machined bearing plates on 10 lb. sheet lead, on stone pads. The flanges of the plate girders are 14 in. wide, and made up of three flats, each ¾ in. thick, and angles 6 in. by 6 in. by ½ in., the web is ½ in. thick, with stiffeners spaced 6 ft. apart centres. Trough decking 1 ft. 5½ in. deep, resting on the lower flange of the plate girders, covered with 1 in. of asphalt, forms the floor of the bridge. The roadway is wood paving on 9 in. of concrete. The footways are carried on trough decking 7 in. deep, riveted to the web of the plate girders. Short specification tests are as follows: Bricks should be sound and hard and well burnt, should weigh about 7 lb., and should not absorb more than one-sixth their weight of water. Cement should be from approved manufacturers, and should conform in every respect with the British Standard Specification. Steel for girders and trough decking should give the following results under test—viz., 28 tons ultimate tensile stress per square inch, with an elongation of 20 per cent in 8 in., and a 40 per cent reduction of area at point of fracture. A suitable test for the completed bridge would be a traction engine drawing a boiler wagon with the following axle loads: Engine, front axle, 7½ tons; rear axle, 15 tons.



Boiler wagon, front axle, 20 tons; rear axle, 20 tons. Wheel-base of each 14 ft. 6 in., and track 6½ ft. wide, and at the same time a dead load of 1 cwt. per square foot over the remainder of the bridge. This load should be borne without causing any defect whatever, and without causing any deflection greater than $\frac{1}{800}$ of the span. (J. G. W., *Bournpatrick.*)

505. Retaining Wall.—Design a retaining wall in reinforced concrete, giving detailed calculations. The height of proposed wall 35 ft., earth retained, dry gravel; foundation similar. (H. T.)

The wall may be of thin reinforced concrete, section of the inverted T type, with spreading base or footing, or of the counterfort type, the wall itself being of thin section, reinforced by buttresses or counterforts. The construction of the former type is simpler, but on account of the very considerable height of the wall the appended design is of the latter form of construction. The following assumptions are made: (1) That the concrete be of the proportions 1:2:4, (2) that the safe bearing strength of the subsoil be 5 tons per square foot, (3) that the gravel which the wall is to support weighs 135 lb. per cubic foot, and that its angle of repose is 30 deg., (4) that the reinforced concrete weights 150 lb. per cubic foot, and (5) that there is no surcharge. The working stresses have been taken as follows:—

Concrete in compression f_c = 600 lb. per sq. in.
Steel in tension f_s = 16,000 lb. per sq. in.
Ratio of moduli of elasticity m = 15

In the type of wall under consideration the vertical slab acts as a slab supported by the buttresses, the principal steel being horizontal. The buttresses act as cantilevers fixed to the footing, and tie the embedded footing to the vertical slab. The projecting toe of the footing is also a canti-

PHOTO-M(

OF CLINKER[S]

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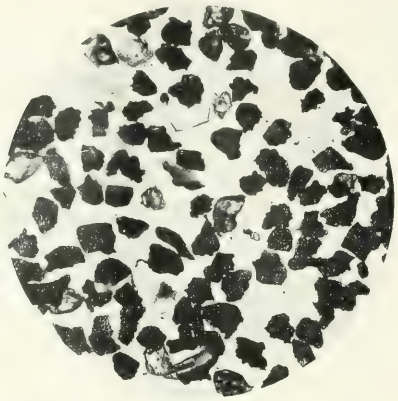

FIG. 1.

Destructor clinker. Mainly ragged-edged and angular, with a few sub-angular fragments which are opaque, mixed with a few translucent angular grains of glass.

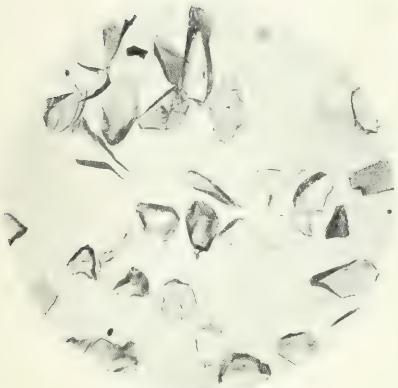

FIG. 2.

Crushed quartz. Marked angularity; no rounding.

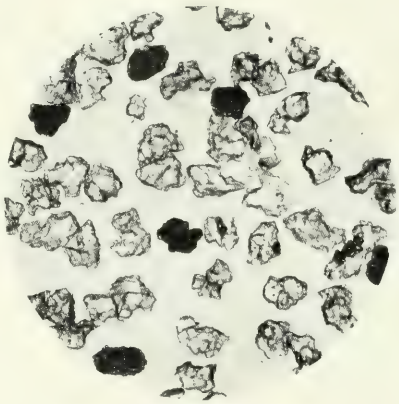

FIG. 3.

Grains from flexible sandstone, India. Marked angularity and irregularity of contour.

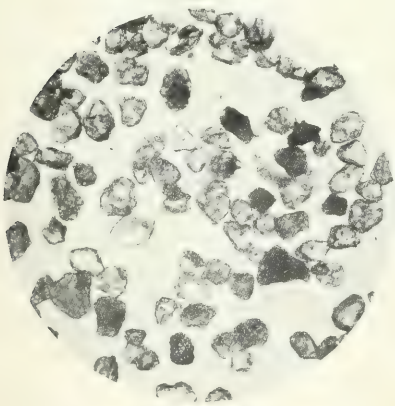

FIG. 4.

Minera. Decomposed grit Quartz grains, with angular and roughened surfaces, caused by a regrowth of silica on more rounded grains.

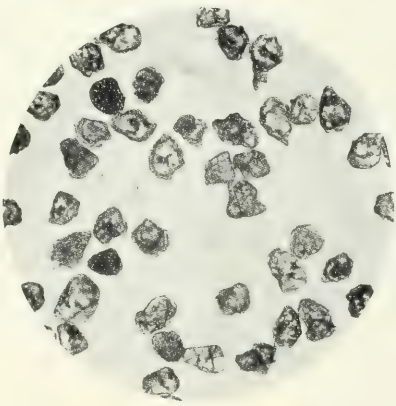

FIG. 5.

Penrith sandstone. Quartz grains, formerly sub-angular and rounded, are now angular through a secondary growth of silic[a]

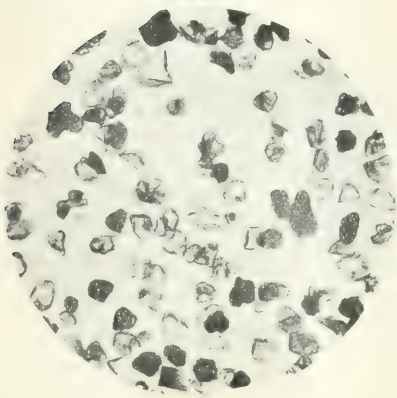

FIG. 6.

Erith loam. Angular to sub-angular quartz, with a considerable amount of stained and earthy grains.

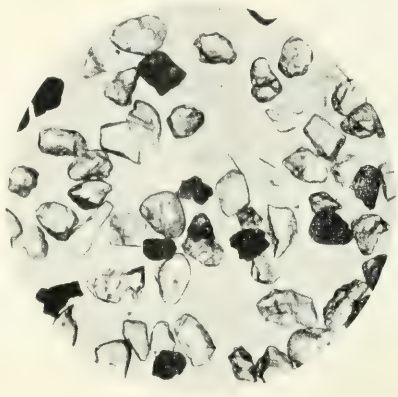

FIG. 7.

Leighton Buzzard. A mixture of angular and sub-angular an well-rounded quartz grains. The black grai are iron-staine quartz and felspar.

?OGRAPHS

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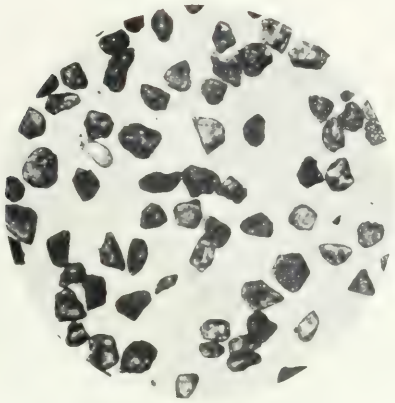
Fig. 8
Gasworks clinker
Ragged-edged and angular, with a few subangular grains and a few glassy particles



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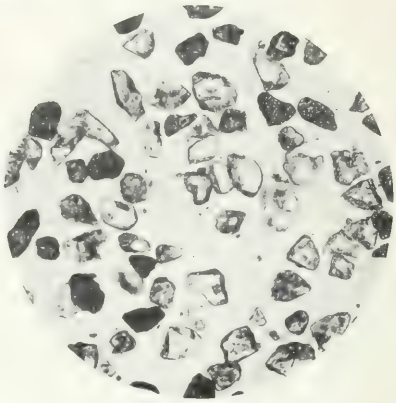
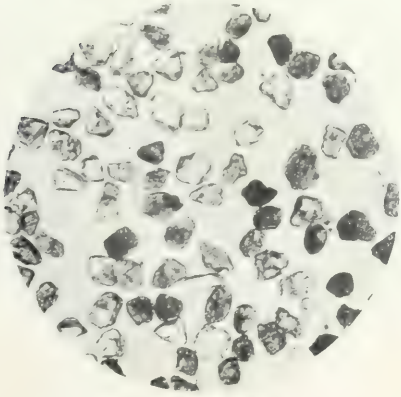


Fig. 10
Reigate
Subangular dark grains are monostained



L. 11
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Subangular to
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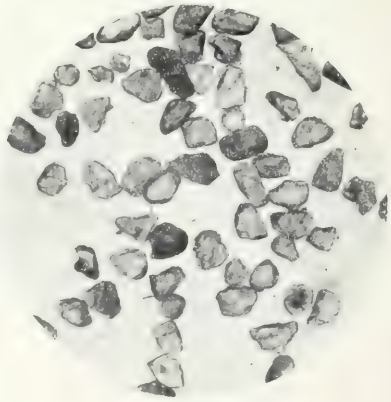
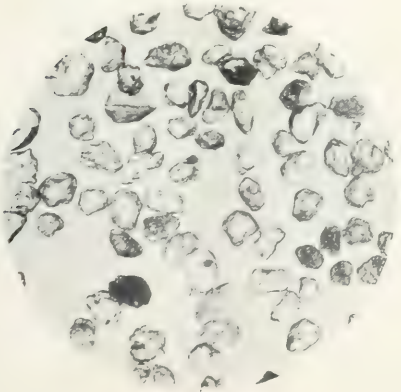


Fig. 12
Westleton,
Suffolk
Subangular to rounded



F. 13.
Aisford.
Mostly
subangular, with
some well-
rounded grains.

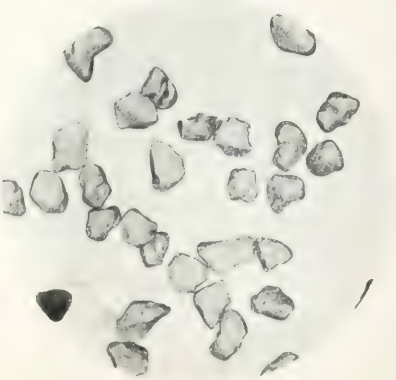


Fig. 14.
Desert sand,
Sahara. Smooth and rounded grains

The Surveyor
And Municipal and County Engineer.

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lever, and the embedded footing is a slab supported by the buttresses. A fair value for the bending moment will be $\frac{wl^2}{10}$, since the slabs are partly continuous, and the end fastening in such cases is of necessity a matter of some ambiguity. A suitable spacing for the buttresses in this instance is 16 ft. apart centre to centre. We can now consider the vertical wall, which is best treated as a series of narrow horizontal strips as slabs supported by the buttresses, loaded uniformly and partly continuous. The pressure evidently varies from a maximum at the bottom of the wall to zero at the top. The pressure at the bottom

$$= wh^2\left(\frac{1-\sin\theta}{1+\sin\theta}\right),$$

where w = weight of unit vol. of earth
h = height of earth retained
θ = angle of repose of earth

$$135 \times 35 \times \left(\frac{1-\frac{1}{2}}{1+\frac{1}{2}}\right) = 1575 \text{ lb. per sq. ft. or } 131 \text{ lb.}$$

per ft. of width for 1 in. of height. Also $M = \frac{wl^2}{10}$

$$= \frac{131 \times 256 \times 12}{10} = 40250 \text{ in. lb. per inch of width.}$$

By the formula deduced from the straight line theory $d = c\sqrt{M}$

where d = depth of slab from compression fibres to centre of steel in inches.
M = bending moment per unit width in in. lb.
c is a constant dependent upon the ratio $f_c : f_s = m$.

In this case we have $d = \cdot 103\sqrt{40250}$, $\cdot 103$ being the value of c for the stresses given, $\therefore d = 20$ in. approximately. This will be 22 in., including cover for reinforcement.

Also area of steel, $A_s = pbd$
$= \cdot 0067 \times 12 \times 20 = 1 \cdot 628$ sq. in.

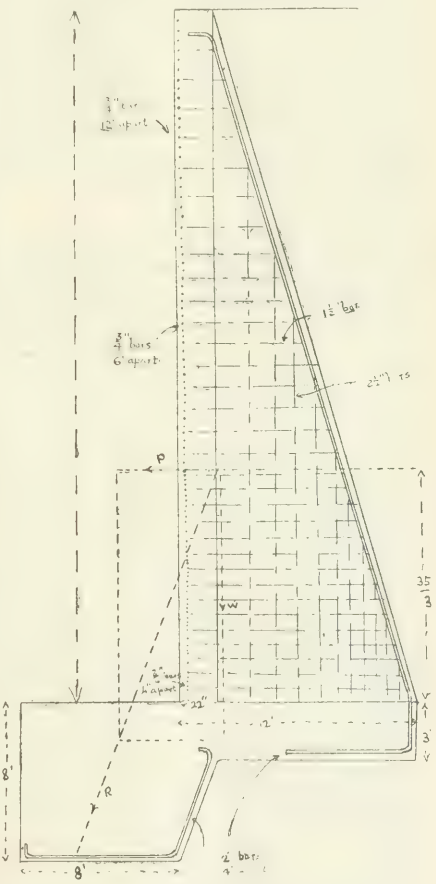
per ft. of height, p being a constant depending upon the ratio $f_c : f_s : m$, and being $\cdot 0067$ for the stresses given. Thus ¾-in. diameter circular rods, placed 4 in. apart, may be used. The construction will be much simplified if the thickness of the slab be uniform, and the rods placed closer together as the earth pressure increases. Short rods may be placed in front of the buttresses in order to take the negative bending moment at those points, or the rods may be suitably bent. Regarding the buttresses, it is evident that they are merely vertical cantilevers; the thickness of the buttress is a matter of judgment, and to find the amount of steel required we have (considering 1 ft.-run of wall)—

Total earth pressure $\frac{wh^2}{2}\left(\frac{1-\sin\theta}{1+\sin\theta}\right) \quad \frac{135 \times 35^2}{2}\left(\frac{1-\frac{1}{2}}{1+\frac{1}{2}}\right)$

27562·5 lb. acting horizontally $\frac{35}{3}$ ft. from bottom of wall. $\therefore$ Total load transmitted to buttress $= 16 \times 27562{\cdot}5$ $= 441000$ lb. $\therefore$ Bending moment $= \frac{35 \times 441000 \times 12}{3}$ $= 61{,}740{,}000$ in. lb. Let maximum width of buttress be 12 ft. and thickness 4 ft., then we have $b = 48$ in. and d the depth from compressive edge to centre of steel $= 144$ in. In our previous formula, $d = c\sqrt{M}$, M being per in. width. $\therefore d = c\sqrt{\frac{M}{b}}$, M being total bending moment and b being breadth.

$$\therefore c = \sqrt{\frac{bd^2}{M}} = \left(\frac{48 \times 144^2}{61{,}740{,}000}\right)^{\frac{1}{2}} = \cdot 1234.$$

From tables of constants (Taylor & Thompson's



"Concrete, Plain and Reinforced"), the value of p corresponding with this value of c, and with f_c and f_s, as given above, is ·005. $\therefore$ from our previous formula we have $A_s = pbd = \cdot 005 \times 144 \times 48 = 34{\cdot}56$ sq. in. $\therefore$ twelve bars, circular, 2 in. in diameter, will suffice. The position of the buttress receiving the greatest tension is, of course, the inclined edge, so the bars are, as shown in the sketch, near to this edge. In practice, horizontal and vertical bars would be added to the horizontal and vertical slabs, and to the buttress to distribute the loads and to provide for diagonal tension. These bars are always bent into the slabs to improve the bond. The 2-in. tension bars in the buttress should also be hooked into the horizontal slab. For the horizontal footing slab we have—

Intensity of stress due to earth upon footing $= \frac{35 \times 135 \times 19}{9\frac{1}{2} \times 2}$
$= 4725$ lb. per sq. ft. compression.

Ditto due to horizontal earth pressure acting as a cantilever about base,

$$f = \frac{6WL}{bd^2} = \frac{6 \cdot 27562{\cdot}5 \times 35}{3 \cdot 400} = 4822 \text{ lb. sq. ft.}$$

This is a tensile stress. ∴ nett intensity = 4822 − 4725 = 97 lb. per square foot tension. This stress, however, will be easily counteracted by the weight of the horizontal and vertical slabs. A 3-ft. slab will be advisable in this case, and as the upward and downward forces give the above result, reinforcement will not be necessary in this slab. There is not space here to go into the calculations for the stirrup reinforcement, but on account of the considerable width of the buttress the latter will not be required. For the toe of the wall we have, supposing the projection to be 8 ft.

$$f = \frac{6\,W\,l.}{bd^2} = \frac{6 \cdot 27562{\cdot}5 \times 35}{3 \times 2240 \cdot 100} = 2{\cdot}154 \text{ tons per sq. ft.}$$

There will be a slight addition to this quantity for the weight of horizontal and vertical slabs; but it is evident that we are well within the limit of the bearing strength of the soil below the wall. This toe should be reinforced, for we have—

$$\text{Average bending moment} = \frac{2{\cdot}154 \cdot 2240 \cdot 64 \cdot 12}{2 \times 2}$$

= 1,850,000 in. lb., ∴ depth of steel below compressive edge = $\cdot 103\sqrt{1{,}850{,}000} = 8$ ft. Thus the toe must be 8 ft. thick and A. = ·0067 · 12 × 96 = 8·7 sq. in. per ft. run. 2 in. diameter circular bars spaced 4 in. apart will suit.

The three reinforcements can be tested for bond stress as follows: By Prof. Talbot's formula

$$u = \frac{V}{jd\Sigma 0}$$

where u = unit bond in lb. per sq. in. of surface area
V = total shear in lb.
jd = distance between centres of tension and compression, generally taken as $\frac{7}{8}\,d$
$\Sigma 0$ = sum of perimeters of all the bars.

Buttresses—

$$u = \frac{27562{\cdot}5 \times 16}{144 \cdot \cdot 875 \times 12 \times 2 \cdot 3{\cdot}142} = 56 \text{ lb. per sq. in.}$$

Vertical slab—

$$u = \frac{1575 \times 8 \times 2}{6 \cdot 24 \cdot \cdot 875 \cdot \cdot 75 \cdot 3{\cdot}142} = 77{\cdot}4 \text{ lb. per sq. in.}$$

Toe—

$$u = \frac{2 \times 2{\cdot}154 \times 2240 \times 2 \cdot 8}{3{\cdot}142 \times 4 \cdot 4 \times 96 \cdot \cdot 875} = 37 \text{ lb. per sq. in.}$$

All these values come within the safe stress assumed above. The design is now complete, and can be tested against failure (1) by settling, (2) by overstressing, (3) by overturning, (4) by sliding.

Causes (1) and (2) will be found to have been examined in the above working. The centre of gravity of the figure has been assumed to be approximately 10·3 ft. from AB produced. The total downward weight = weight of structure and weight of earth upon right-hand footing = 386,400 + 744,400 = 1,130,800 lb. Also horizontal force = 441,000 lb., and we see from the figure and parallelogram that the resultant of these forces falls inside the base, so that failure from cause (3) is impossible. For (4), we have, assuming angle of friction between base of wall and subsoil to be ·6, ratio of horizontal to vertical forces = $\frac{441{,}000}{1{,}130{,}800}$ = ·4 approximately, so that sliding is impossible. Note that provision should be made for changes in temperature by means of expansion joints. (B. K., *Liverpool*.)

Notes.

We are indebted to Mr. A. E. Collins, M.Inst.C.E., the city engineer of Norwich, for the following:—

Believing the answer to Question 503, in this week's Surveyor, may result in further inefficient sewer syphon construction, I think it proper to warn engineers engaged in sewerage against such a method as that proposed by "J. A. R." In general practice, for such a situation, the most convenient method is to construct the inverted syphon of cast-iron pipes of the same diameter as the sewer proper, provided with facing, trailing and angle bends arranged to give the easiest possible flow at about the same velocity throughout. The vertical pipes should be placed in manholes, there should be emptying valves and inspection covers at the bottom bends, and inspection covers at the top ones. I have, in the course of my experience, been compelled to use a considerable number of syphons on sewers, some dipping a very considerable depth. I have never had one of them blocked; but, notwithstanding, I prefer to have the means of access and emptying named. If properly designed, I see no reason for duplicating. I have never done so. With "J. A. R.'s" scheme, I think duplicating would be necessary, as I should expect silting in the manholes, where the velocity would be relatively small. Some engineers prefer to make the bottom of a syphon and the rising leg of smaller area than the sewer and falling leg, with the object of gaining higher velocity. I have found equal areas throughout quite satisfactory. I have never allowed road-surface water to enter a syphon, and think it should be freed of heavy grit before being allowed to do so.

COMPARATIVE REPORTS OF GENERAL PRACTICE.

LXXXII.—COLLECTION OF TRADE REFUSE.

The following information with regard to the collection of trade refuse has been compiled by Mr. R. A. MacBrair, M.Inst.C.E., city engineer and surveyor of Lincoln, from returns which he obtained from seventy-seven other towns:—

Name of town.	Is trade refuse collected?	Is charge made for collection?	Charge for collection.
Aberdare	No	—	—
Accrington	,,	—	—
Ashton-under-Lyne	Yes	Yes	12 - per annum.
Bacup	,,	,,	2 - to £2 7s. 6d. per ann.
Barking	,,	No	—
Bedford	,,	,,	—
Blaydon-on-Tyne	No	Yes	—
Bolton	Yes	,,	2/6 per load.
Bootle	,,	,,	2 - per ton.
Brighton	,,	,,	4½d. per sack or 6 - per ton
Bristol	,,	,,	2/6 per load.
Burnley	,,	,,	1/6 per load.
Cardiff	,,	No	—
Carlisle	,,	,,	—
Chatham Borough	,,	,,	—
Cheltenham	,,	,,	—
Chiswick	,,	Yes	5 - per load.
Colchester	,,	No	—
Coventry	,,	,,	—
Crewe	,,	,,	—
Croydon	,,	Yes	2/6 per load.
Derby	,,	No	—
Devonport	,,	,,	—
Doncaster	,,	,,	—
Dover	No	—	—
Dudley	Yes	Yes	2 - per load.
Enfield	,,	,,	6d. collection.
Erith U.D.	,,	,,	2/6 per load.
Folkestone	,,	No	—
Gateshead	,,	Yes	According to cost.
Gillingham	,,	No	—
Gloucester	,,	,,	—
Grimsby	,,	,,	—
Guildford	,,	,,	—
Hove	No		—
Huddersfield	Yes	Yes	3 - per load to £100.
Hyde	,,	,,	3d. per box.
Ilford	,,	No	—
Ipswich	No	—	—
Keighley	Yes	No	—
Kettering	,,	Yes	1 - per load.
King's Lynn	,,	No	—
Leeds	,,	Yes	2/6 per load.
Lincoln	,,	No	—
Macclesfield	,,	,,	3d. per ton.
Maidstone	No	—	—
Middlesbrough	Yes	No	—
Nelson	,,	Yes	1 - per load.
Newport (Mon.)	,,	,,	1/6 per ton; vegetable 4d. per cwt.
Northampton	,,	No	—
Norwich	,,	Yes	2/1 cubic yard.
Oxford	,,	,,	2/- per load.
Plymouth	,,	,,	2/6 per van load.
Pontypridd	,,	,,	2/6 per load.
Reading	,,	,,	In accordance with cost.
Richmond (Surrey)	No		—
Rochester	,,	-	—
Rotherham	,,	—	—
Scarborough	Yes	No	—
Shrewsbury	No	—	—
Southend-on-Sea	Yes	No	—
Southport	,,	Yes	2 - per van load.
Stafford	,,	,,	1d. per tub.
Stanley (Durham)	,,	No	—
Stoke-on-Trent	,,	Yes	1 - per load.
Swansea	,,	No	—
Swindon	,,	Yes	1 - per load.
Torquay	,,	No	—
Tunbridge Wells	,,	,,	—
Walsall	,,	Yes	3/- per load.
Warrington	,,	,,	3/- per load.
West Bromwich	,,	,,	2 - per load.
West Hartlepool	,,	No	—
Widnes	,,	,,	—
Withington (Manchester)	,,	Yes	6/6 per load if specially collected.
Wolverhampton	,,	,,	2/6 per load.
York	,,	,,	In accordance with cost.

Summary of Replies re Trade Refuse.

Towns possessing a destructor: Aberdare, Accrington, Ashton-under-Lyne, Bolton, Bootle, Brighton, Bristol, Burnley, Cheltenham, Chiswick, Coventry,

Croydon, Derby, Dudley, Folkestone, Gloucester, Guernsey, Guildford, Huddersfield, Hyde, Ipswich, Kettering, Lincoln, Nelson, Northampton, Pontypridd, Plymouth, Rotherham, Southport, Stafford, Stoke-on-Trent, Swansea, Torquay, Warrington, West Bromwich, West Hartlepool, Withington, Wolverhampton, York—thirty-nine.

Towns not possessing a destructor: Bacup, Barking, Bedford, Blaydon-on-Tyne, Cardiff, Carlisle, Chatham Borough, Colchester, Crewe, Devonport, Doncaster, Dover, Enfield, Erith Urban District, Gateshead, Gillingham, Hove, Ilford, Keighley, King's Lynn, Macclesfield, Maidstone, Middlesbrough, Norwich, Oxford, Reading, Richmond, Rochester, Scarborough, Shrewsbury, Southend-on-Sea, Stanley (Durham), Swindon, Tunbridge Wells, Walsall, Widnes—thirty-six.

Towns where trade refuse is collected—sixty-four.

Towns where trade refuse is not collected—eleven.

Towns where a charge is made for collecting—thirty-three.

Towns where a charge is not made for collecting—thirty-one.

Charges for collection vary from 1d. per tub to an annual one of £100.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

COUNCIL MEETING.

A meeting of the council of the Institution of Municipal and County Engineers was held at 92 Victoria-street, Westminster, S.W., on Saturday morning, September 25th, when the business set out below was transacted. There were present: Messrs. T. W. A. Hayward (vice-president, in the chair), W. Nisbet Blair, Chas. Brownridge, E. E. W. Butt, G. F. Carter, J. W. Cockrill, P. Dodd, E. J. Elford, H. P. Foster, W. T. Lancashire, Frank Massie, P. H. Palmer, R. J. Thomas, E. Willis, O. E. Winter, and the secretary.

STANDING COMMITTEES.

The committee appointed for this purpose submitted the following recommendation with regard to the membership of the Standing Committees for 1915-16, of each of which the president and honorary treasurer are ex-officio members:—

That the Standing Committees be constituted as follows:

General Purposes: Messrs. J. P. Barber, W. N. Blair, J. S. Brodie, C. Brownridge, E. E. W. Butt, W. Harpur, T. W. A. Hayward, W. T. Lancashire, F. Massie, J. S. Pickering, W. H. Prescott, O. E. Winter.

Finance and Journal: Messrs. J. S. Brodie, G. F. Carter, J. W. Cockrill, F. C. Cook, T. W. A. Hayward, W. Jones, P. H. Palmer, J. S. Pickering, N. Scorgie, W. Stubbs, E. Willis, O. E. Winter.

Town Planning: Messrs. J. W. Cockrill, W. Harpur, W. T. Lancashire, E. B. Martin, E. G. Mawbey, T. Moulding, L. Roseveare, W. J. Steele, H. E. Stilgoe, W. Stubbs, J. A. Webb, C. F. Wike.

Standardisation: Messrs. H. P. Boulnois, H. W. Bowen, A. W. Bradley, A. E. Collins, P. Dodd, R. H. Dorman, E. J. Elford, E. B. Martin, W. B. Purser, A. Stevenson, R. J. Thomas, E. Willis.

Roads and Tramways: Messrs. H. W. Bowen, A. W. Bradley, J. A. Brodie, A. E. Collins, R. H. Dorman, E. J. Elford, H. P. Foster, E. P. Hooley, G. A. Phillips, A. Stevenson, H. E. Stilgoe, R. J. Thomas.

The recommendation was approved and the Standing Committees appointed accordingly. It was resolved that the question of an increase in the numbers of the General Purposes Committee be referred to the General Purposes Committee for consideration and a report.

At a subsequent meeting held in the afternoon there were present: Messrs. T. W. A. Hayward (vice-president, in the chair), W. Nisbet Blair, H. P. Boulnois, J. S. Brodie, Chas. Brownridge, E. E. W. Butt, G. F. Carter, J. W. Cockrill, P. Dodd, E. J. Elford, H. P Foster, W. T. Lancashire, E. B. Martin, Frank Massie, P. H. Palmer, R. J. Thomas, J. A. Webb, C. F. Wike, E. Willis, O. E. Winter, the consultant secretary and the secretary.

EXAMINATION APPLICATIONS.

The president reported that, in accordance with the authority granted to Mr. J. Patten Barber and himself, permission to sit for the examinations of the institution had been granted to Messrs. P. Fairclough, R. H. Herd, J. T. Robinson, W. Y. Smith Saville, and P. Williams.

APPOINTMENT OF ACTING EXAMINERS.

The president reported that, in accordance with the authority granted to the chairman of the board of examiners and himself, the acting examiners for the October, 1915, examinations had been appointed as follows:—

Engineering I., Mr. A. E. Collins; Engineering II., Mr. J. S. Pickering; Building Construction, Mr. T. W. A. Hayward; Sanitary Science, Mr. G. Green; Municipal Law, Mr. S. G. Turner; Municipal Law (S. African), Dr. Mitchell; Town Planning, Mr. J. S. Brodie; Superintending Examiner, Mr. A. E. Collins.

ROADS AND TRAMWAYS COMMITTEE.

Mr. R. J. Thomas reported that a meeting was held on September 25th, and that the business set out below was transacted.

Present: Messrs. R. J. Thomas (in the chair), H. P. Boulnois, E. J. Elford, and H. P. Foster.

Election of Chairman.—It was resolved that Mr. R. J. Thomas be elected chairman of the committee for the year 1915-16.

Election of Vice-chairman.—It was resolved that Mr. E. J. Elford be elected vice-chairman for the year 1915-16.

Co-option of Members.—It was resolved that Mr. C. S. Morris, county surveyor, Northamptonshire, and Mr. H. P. Boulnois be co-opted members of the committee.

Standardisation of Slag.—It was resolved to defer the consideration of this question until the next meeting of the committee, and to ask the members of the committee to consider the matter in the meantime, and to submit suggestions.

Road Statistics.—It was resolved to defer the consideration of this question until the purport of the suggestion had been ascertained.

GENERAL PURPOSES COMMITTEE.

Mr. W. N. Blair reported that a meeting was held on September 25th, and that the business set out below was transacted.

Present.—Messrs. W. N. Blair (in the chair), J. S. Brodie, C. Brownridge, E. E. W. Butt, T. W. A. Hayward, W. T. Lancashire, F. Massie, and O. E. Winter.

Election of Chairman.—It was resolved that Mr. J. Patten Barber be elected chairman of the committee for the year 1915-16.

Election of Vice-chairman.—It was resolved that Mr. W. Nisbet Blair be elected vice-chairman of the committee for the year 1915-16.

Applications for Membership.—It was resolved to recommend the following gentlemen for election to membership: Messrs. Thomas Bull, engineer and surveyor to the Thurnscoe Urban District Council; C. H. Cooper, borough engineer, Wimbledon; S. H. Davies, acting highway surveyor to the Wirrall Rural District Council; James Diggle, borough and water engineer, Hyde; C. T. Hague, surveyor to the Ulverston Urban District Council; F. Heath, chief engineering assistant, Rawmarsh Urban District Council; V. J. O'Connell, engineer to Newry Port and Harbour Trust; T. H. Richards, surveyor to the Caerphilly Urban District Council; C. S. Righton, engineer and surveyor to the Disley Rural District Council; and R. M. Stone, county surveyor, North Devon, Barnstaple.

Applications for Associate Membership.—It was resolved to recommend the following gentlemen for election to Associate Membership: Messrs. S. G. Hay, assistant to borough engineer, Brighouse; W. J. Houghton, engineering assistant to Cape Town Corporation; W. Melville, assistant to borough engineer, Barrow-in-Furness; S. W. Mobbs, assistant to borough surveyor, Lowestoft; H. Nurse, engineering assistant to borough surveyor, Warrington; J. A. Riccomini, assistant valuer, Valuation Department, Inland Revenue.

Applications for Studentship.—It was resolved to recommend the following gentlemen for election to studentship: Messrs. R. C. Bonnaud, borough engineer's office, Croydon, and H. G. F. Petty, assistant surveyor to borough engineer, Dorchester.

Transfer from Associate-member to Member.—It was resolved to recommend that the following gentleman be transferred from the class of associate-members to that of members: Mr. A. S. V. Taylor, engineer and surveyor to the Bedwas and Machen Urban District Council.

Transfers from Student to Associate-member.—It was resolved to recommend that the following gentle-

men be transferred from the class of students to that of associate-members: Messrs. T. F. Allen, subordinate officer (civil engineering), director of works department, Admiralty, and W. A. Walker, engineering assistant to city engineer, York.

Deaths.—The secretary reported the deaths of Messrs. W. Hosken (West Sussex), who was killed on active service, R. Phillips (Gloucester), J. Wilson (Bacup), W. Wilson (Portadown). It was resolved to recommend that letters of condolence be addressed to the relatives.

Examination Application.—It was resolved to recommend that permission to sit for the institution's examinations be granted to Mr. B. F. Holness.

Badge for President and Vice-presidents.—It was resolved to recommend that the consideration of the provision of a badge for each president and vice-president be deferred until the end of the war, as it did not appear to be an opportune time to incur any additional expenditure.

Indication of Professional Qualifications in the List of Members.—It was resolved to recommend that, in addition to the indication of the possession of university degrees and membership of the Institution of Civil Engineers, that membership of the following bodies be also indicated in the list of members—viz., Surveyors' Institution, Institution of Mechanical Engineers, Institution of Electrical Engineers, Royal Institute of British Architects.

Representatives on the National Council of the National Association of Local Government Officers.—It was resolved to recommend that Mr. A. D. Greatorex and Mr. Norman Scorgie be nominated as representatives of the institution on the above-mentioned body for the year 1915-16. It was further resolved to recommend that Mr. Norman Scorgie be nominated to represent the institution on the General Purposes Committee of that body.

Guarantors to Builders' Contracts.—A letter was received from the Builders' Materials Central Committee, dated June 22, 1915, asking for the support of the council to the substitution of approved guarantee companies for personal guarantees to builders' contracts. It was resolved to recommend that the committee be informed that approved guarantee companies are already frequently accepted for this purpose, and that the council are not, therefore, prepared to take any action in the matter.

Alien Enemy Danger.—A letter was received from the Kensington Municipal Officers' Guild, dated July 14, 1915, enclosing a copy of resolutions dealing with the alien enemy danger, and it was resolved to recommend that the sympathy of the council in the matter be expressed.

Professional Classes War Relief Council.—A letter was received from Mr. A. S. E. Ackermann, dated August 23, asking for the support of the council in arranging the Christmas Fair at the Albert Hall proposed by the Professional Classes War Relief Council. It was resolved to recommend that Mr. Ackermann be informed that the council are unable to make contributions towards benevolent funds from the institution funds; but they are generally in sympathy with the proposal, and will print any matter in the "Journal" of the institution which may be suggested by the committee in charge of the arrangements after conference with the secretary of the institution. A letter was also received from the hon. secretary of the Professional Classes War Relief Council, dated September 16, inviting the council to nominate the president and secretary as members of the council. It was resolved to recommend that the invitation be accepted provided the president and secretary can see their way to serve.

Institute of Industry.—A letter was received from the Institute of Industry, dated September 6, with reference to the proposed exhibition of the Empire and British Industries, and it was resolved to recommend that no action be taken in the matter.

The recommendations were approved and adopted by the council.

STANDARDISATION COMMITTEE.

Mr. E. J. Elford reported that a meeting was held on September 25th, and that the business set out below was transacted.

Present: Messrs. E. J. Elford (in the chair), H. P. Boulnois, P. Dodd, E. B. Martin, R. J. Thomas, and E. Willis.

Election of Chairman.—It was resolved that Mr. E. J. Elford be elected chairman of the committee for the year 1915-16.

Co-option of Members.—It was resolved that Mr. F. W. Pearce, engineer and surveyor, Twickenham Urban District Council, be co-opted a member of the committee.

Standardisation of Slag.—It was resolved to recommend that the members of the Standardisation Committee be asked to co-operate with the members of the Roads and Tramways Committee in obtaining information on this subject.

Standardisation of Statistics.—It was resolved to recommend that each member of the committee be asked to consider this question, and that the matter be discussed at the next meeting.

FINANCE AND JOURNAL COMMITTEE.

Mr. J. W. Cockrill reported that a meeting was held on September 25th, and that the business set out below was transacted.

Present: Messrs. T. W. A. Hayward (in the chair), J. S. Brodie, G. F. Carter, J. W. Cockrill, P. H. Palmer, E. Willis, and O. E. Winter.

Election of Chairman.—It was resolved that Mr. T. W. A. Hayward be elected chairman of the committee for the year 1915-16.

Election of Vice-chairman.—It was resolved that Mr. J. W. Cockrill be elected vice-chairman of the committee for the year 1915-16.

Accounts.—It was resolved to recommend the payment of accounts amounting to a total of £797 11s. 11d.

Accounts Sub-committee.—It was resolved that the following members be appointed a sub-committee to examine the accounts before each meeting of the Finance Committee: Messrs. G. F. Carter, J. W. Cockrill, T. W. A. Hayward, W. H. Prescott, Norman Scorgie, and O. E. Winter.

The recommendations were approved and adopted by the council.

TOWN PLANNING COMMITTEE.

Mr. J. W. Cockrill reported that a meeting was held on September 25th, and that the business set out below was transacted.

Present: Messrs. J. W. Cockrill (in the chair), E. J. Elford, W. T. Lancashire, E. B. Martin, J. A. Webb, and E. Willis.

It was resolved that Mr. J. W. Cockrill should take the chair pro tem.

Election of Chairman.—It was resolved that Mr. H. E. Stilgoe be elected chairman of the committee for the year 1915-16.

Election of Vice-chairman.—It was resolved that Mr. C. F. Wike be elected vice-chairman of the committee for the year 1915-16.

Co-option of Members.—It was resolved that Messrs. E. J. Elford, G. A. Phillips, and E. Willis be co-opted members of the committee.

ARTICLED PUPILS ON ACTIVE SERVICE.

After a discussion on the position of articled pupils on active service, the secretary was instructed to inquire of the Institution of Civil Engineers as to whether that body had decided to accept the period of time on active service as forming part of the qualifying period of training or experience for election as a member or associate-member of that institution.

DEPARTMENTAL COMMITTEE ON HEAVY TRAFFIC.

A letter was received from the Municipal Tramways Association, dated June 16th, offering assistance in the preparation of evidence. It was resolved that the association be informed that the evidence of the institution had already been tendered, and that the council were not prepared to take any further action in the matter.

RULES AND SCALES OF FEES FOR SALARIED ENGINEERS.

A letter was received from the Society of Engineers, dated June 17th, inviting the appointment of representatives for a general conference on this question. Before considering the matter further it was resolved that the secretary be instructed to obtain particulars of the scales, &c., already prepared for consulting engineers.

PHOTOGRAPHS.

A letter was received from Sir James Lemon offering to present photographs of the meetings of the institution in Paris, Norwich and Buxton to the institution. It was resolved that the thanks of the council be conveyed to Sir James, and that his kind offer be accepted.

TAXATION OF SURVEYORS' MEANS OF LOCOMOTION.

A letter was received from Mr. W. B. Purser with reference to this question, and it was resolved that he be informed that this matter was considered in January and February, 1914, and that representa-

tions were made to the Chancellor of the Exchequer [illegible]. Having regard to this and the present state of public affairs, the council did not consider it an opportune time to reopen the question.

PORTRAITS OF PAST-PRESIDENTS.

The secretary reported that Mr. R. J. Thomas had kindly presented his portrait to the institution for addition to the collection hung in the Council Chamber. It was resolved to tender the thanks of the council to Mr. Thomas for the gift.

NORTH-EASTERN DISTRICT MEETING.

A North-Eastern District meeting will be held at Brighouse to-morrow (Saturday).

PROGRAMME.

2.30 p.m.—Meet at the Municipal Buildings, Thornton-square.

Short paper on "The Duties of a Municipal Engineer in the Present War," by [illegible] S. S. Haywood (member), borough engineer and surveyor, Brighouse.

Business:—

(1) Correspondence (if any).

(2) Minutes of last meeting held at Scarborough on Saturday, May 8th, 1915.

(3) Election of Executive Committee.

(4) To further consider the recommendation of the Executive Committee on the question of the reporting of District meetings.

(5) Any other business.

Inspection of aëration and filtration plant at the swimming baths.

5 p.m.—Tea, by kind invitation of Mr. S. S. Haywood, borough engineer and surveyor.

F. O. KIRBY, M.SC., ASSOC.M.INST.C.E.,
Hon. District Secretary.

Pudloed Cement for Water Towers.—The Wholesale Co-operative Society's architect (Newcastle) reports that the water tower connected with the new West Hartlepool Co-operative buildings has been made watertight by using Pudloed cement.

The Golden Dustman.—The late Mr. Charles Murrell, of Albion-place, Blackfriars, S.E., contractor for the removal of dust to many London boroughs and district councils, who died on September 11th, left £13,510 (as far as can at present be ascertained).

Glasgow Corporation's New Baths and Wash-house.—New public wash-house and baths erected by Glasgow Corporation in Morrison-street, South Side, Glasgow, were formally opened recently. The new building has been erected at an estimated cost of £10,000.

Increased Production of Mexican Asphalt.—A correspondent states that, according to the United States Geological Survey, the total production of asphalt in the United States in 1914 was 752,068 short tons, valued at $7,788,736. These totals were made up as follows: Natural asphalt, 77,588 tons; asphalt from domestic petroleum, 360,683 tons; refined from Mexican petroleum, 313,787 tons. Compared with 1913, the output of natural asphalt in 1914 declined 10 per cent, and that of domestic asphalt 17 per cent, whereas the output of Mexican asphalt increased 174 per cent.

"Monolastic" in Kensington.—A leaflet issued for Highways Construction, Limited, Finsbury-court, Finsbury-pavement, E.C., describes the operations in connection with the reconstruction of a part of Holland-road, Kensington, with "Monolastic" voidless macadam. The borough engineer has explained to the borough council that in many roads it will doubtless become necessary to renew the foundations, but that there are other roads where the traffic is not so heavy, and where the existing foundations may, with the help of a weight-distributing road crust, be made to serve a further term. It is hoped to obtain this crust by laying on the existing concrete foundations which have not already badly failed a thickness of bituminous concrete covered with a bituminous carpet for a wearing surface. The company above referred to are now laying this paving in a part of Holland-road, covering an area of 2,700 yds. The conditions imposed by the borough council include the following: That no payment be made by the council in respect of the work for a period of twelve months after the road is thrown open to traffic on completion, and then only on the certificate of the borough engineer that the roadway is, in his opinion, in a satisfactory condition, and likely to remain in such condition.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

West Hartlepool T.C. (October 15th. Mr. H. Shelford Bidwell).—This was an inquiry into the water-carriage system, the special point raised being the responsibility of the corporation to bear one-half the cost of conversion in the case of property possessing the older type of sanitary conveniences. The proceedings originated with a memorial from Mr. Thomas Tiplady Brown, of Brentwood House, Harrogate, to the Local Government Board in respect of No. 11 Charles-street, West Hartlepool, at which property the corporation had carried out the conversion and charged him with the whole cost.—Mr. E. Meynell, on behalf of Mr. Brown, said that in the year 1913 no fewer than 724 notices to convert were served on property owners in West Hartlepool, indicating that the corporation had adopted the system as a general policy. Therefore, counsel urged, the corporation could only proceed under the Public Health Amendment Act, 1907, under which the corporation were liable for half the cost of conversion. It was argued that the corporation's sewage scheme was at fault, and that the sewers could not be properly flushed, and that property owners were being compelled to adopt the water-carriage system in order to flush the sewer. The case for the corporation, as presented by the town clerk, Mr. Higson Simpson, was that they had not adopted a general policy of conversion to water carriage under the Act of 1907, although he admitted that one case had been taken under that Act. It was true there had been a considerable number of conversions, but each case was dealt with on its merits under the Act of 1875, and the corporation were therefore not liable for any part of the cost of such conversions. Regarding the sewer, the town clerk admitted that under certain conditions of wind and tide there was a deposit on the beach to some small extent, but that, he added, was the case with any sewer with an outlet into the sea.

APPLICATIONS FOR LOANS.

Birmingham T.C. £50,000, part of a loan previously sanctioned for carbonising plant at Nechells gasworks.

Blaydon U.D.C.—£5,039 for road improvements.

Halifax T.C.—£2,000 for electricity mains.

Hindley U.D.C.—£750 for sewage disposal works.

Hull T.C.—£2,000 for the erection of cottage baths.

Ramsbottom U.D.C.—£2,372 for road improvement.

Whitstable U.D.C.—£3,726 for the sewage disposal scheme.

Wolverhampton T.C.—£6,365 for electricity mains.

LOANS SANCTIONED.

Darlington T.C.—£7,200 for purifiers and a station meter for the gasworks.

Hull T.C.—£47,252 for waterworks.

Kiveton Park R.D.C.—£230 in connection with the Dinnington destructor, and £224 for sewerage works.

Manchester T.C.—£15,480 in connection with the generating station at Barton.

LOAN REFUSED.

Sutton Coldfield T.C.—£2,500 for generating plant.

FORTHCOMING INQUIRIES.

OCTOBER.	£
25.—**Chapel-en-le-Frith.** For the provision of artisans' dwellings (Mr. Courtenay Clifton)	4,500
26.—**Ipswich.** For the purposes of the electricity undertaking (Mr. R. H. Bicknell)	3,100
26.—**Nuneaton.** For the purposes of the electricity undertaking (Mr. H. Shelford Bidwell)	10,000
27.—**Luton.** For the purposes of the electricity undertaking (Mr. H. Shelford Bidwell)	25,650
27.—**Todmorden.** For works of water supply (Mr. P. M. Crosthwaite)	—
28.—**Barrow-in-Furness.** For the extension of the refuse destructor (Mr. P. M. Crosthwaite)	2,000
28.—**Hornsey.** For a scheme for the manufacture of bituminous road materials (Mr. R. H. Bicknell)	5,800
29.—**Shipston-on-Stour.** For works of sewage disposal (Mr. W. O. E. Meade-King) ...	1,470

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Hull, Westhampnett; housing and town planning—Dudley, Lanarkshire; roads and materials—Dorking, Hammersmith, Shoreham, Worthing; sewerage and sewage disposal—Beverley; water, gas and electricity—Dunfermline, Kanturk. Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Chesterfield T.C.—Negotiations are proceeding for the purchase of a site at Brampton, for the purpose of a highway depot.

Essex C.C.—The Local Government Board having suggested alterations of the scheme for enlarging the Black Notley sanatorium, a modified scheme has been prepared, and the tender of Messrs. A. Brown & Son, of Braintree, at £598, has been accepted.

Hebburn U.D.C.—It has been decided to build a public convenience in Argyle-street.

Hull T.C.—The Baths Committee have agreed to seek power to borrow money for the construction of cottage baths adjoining the open-air bath in Albert-avenue. The chairman (Alderman Hall) said he did not think that such a loan would be sanctioned at the present time.

Rochester T.C.—The corporation have sanctioned the use of the Strood recreation ground for military purposes. The War Office propose to erect on the site dining-rooms, cook-house, latrines and urinals and baths for about 1,500 soldiers.

Westhampnett R.D.C.—The Sanitary Committee recommend the council to apply for sanction to purchase a site for an isolation hospital at Summersdale, Chichester. The work of building will not be proceeded with at present.

HOUSING AND TOWN PLANNING.

Atcham R.D.C.—The surveyor, Mr. H. Asher, has received instructions to prepare a town planning scheme.

Birmingham T.C.—The Town Planning Committee have received a communication from the Local Government Board in regard to the North Yardley town-planning scheme. Speaking generally, the proposals of the corporation appeared to meet with the approval of the Local Government Board, but there were a number of details in which further discussion, and possibly modification, will be necessary. A communication was also received from the Local Government Board with respect to the South Birmingham scheme. This raised certain questions in connection with the area to be included in the scheme, and the committee are still engaged in a discussion of these matters.

Chesterfield T.C.—The borough surveyor, Mr. Vincent Smith, has been instructed to report on the condition of certain wooden structures in the borough, which an alderman described as "squalid dog kennels," and which, he said, ought to make way for good property.

Dudley T.C.—If the Local Government Board will contribute £30,000 towards an expenditure estimated at £100,000, for the purchase of land and the erection of 300 houses for artisans, the town council will be prepared to carry out the scheme with the least possible delay. This was practically the decision of the town council at a special and private meeting to consider new and important developments. A resolution to continue negotiations with the Local Government Board was adopted after a long discussion. It is stated that if the corporation refuse to carry out the scheme the Government Department now urging its adoption will erect housing accommodation of a temporary character for the period of the war.

Lanarkshire C.C.—A proposal is under consideration for building about 200 houses at Mossend for munition workers.

Stow R.D.C.—It was reported with reference to the provision of working-class dwellings at Stowupland that a communication had been received from the Local Government Board stating that they would send one of their inspectors on a visit of inspection, and the inspector would afterwards meet the members of the council.

Tilbury U.D.C.—It has been agreed that the rents of the new municipal dwellings in course of erection shall be 5s. 3d., 7s. 3d., and 9s. 6d. weekly for the three classes of houses respectively.

PARKS AND OPEN SPACES.

Manchester T.C.—Mr. Pettigrew, general superintendent of the parks, reports to the Parks Committee as follows: "I am pleased to be able to report that the cutting up of the old tree trunks at Heaton Park and disposing of them as fire-blocks is likely to prove quite a success, for orders are coming in as fast as we are able to execute them. I feel quite confident that householders who once purchase these fire-blocks from your department will only be too pleased to become regular customers." The main object, he adds, in setting up a wood-cutting apparatus at the park is to help in the removal of a great number of dead trees which had been accumulating there for years, in such a way that the work will pay for itself.

REFUSE COLLECTION AND DISPOSAL.

Margate T.C.—It has been agreed to purchase an electric magnetic separator, at a cost of £135, for the purpose of extracting nails and kindred articles from the crushed clinker. It was stated that the separator would save the council £400 per annum in normal times.

ROADS AND MATERIALS.

Ashburton U.D.C.—The surveyor, Mr. A. Wilson, has been instructed to place sand or gravel on the tarred portions of the roads outside the town at least twice a week.

Bonsall U.D.C.—The surveyor, Mr. A. W. Farnsworth, reported that the cost of steam road rolling had gone up to 32s. per day.

Bradford T.C.—With a view to reducing the expenditure on private street works without affecting public health or endangering the safety of vehicular and passenger traffic, the Street, Drainage and Works Committee have revisited and carefully inspected a number of streets. With regard to several streets they have decided that the works already authorised by the council, but not yet begun, should proceed.

Bridgwater R.D.C.—Application has been made for powers to purchase a depot and the necessary land for carrying out the Wembdon Hill improvement. It is not proposed to do the work till after the war.

Bromley T.C.—Instructions have been given to the borough engineer, Mr. Stanley Hawkings, to arrange for the whitening of kerbs, dark corners and refuges.

Castlereagh R.D.C.—It is reported that the increase in the estimate for maintenance of roads compared with last year was £289, of which amount £250 was accounted for by tar, while the remainder was due to the increased cost of labour.—It has been agreed to carry out a widening and improvement scheme on Tullycornett Brae-road.

Chipping Norton T.C.—The Roads and Footways Committee have been authorised to carry out repairs in a number of streets.

Dorking U.D.C.—The necessary preliminaries are to be taken with a view to making up a number of the streets under the Private Streets Works Act.

Essex C.C.—The Highways Committee have reported the completion of the widening of Crown-hill, Rayleigh, at an approximate cost of £1,975, and it was decided to continue the widening further down the hill at an approximate cost of £130, inclusive of purchase of land. An expenditure of £127 on paving and kerbing at Billericay was agreed to. Repairs to Hartford End Bridge, at a cost of £150, were sanctioned. The full cost of Ferry-lane Bridge, Walthamstow, was £8,964, the original estimate, with additions for extra foundations, being £9,801. The committee reported that the expenditure for the past half-year was £88,849, compared with £104,328 estimated, a reduction of £15,479. This partly arose through delays

in carrying out road reconstruction works under the Road Board scheme. They estimated that £108,008 will be required for all purposes during the ensuing half-year, and after deducting the £15,479 mentioned the nett requirements will be £92,529, a nett decrease on the year of £13,373.

Hammersmith B.C.—A decision is reported to have been reached with the London and North-Western Railway Company with regard to the improvement of the Hythe road approach road. The total cost of the work is estimated at £6,500.

Hartlepool T.C.—It has been agreed to purchase a piece of land in front of Sedgewick House for the purpose of street improvement.

Lichfield T.C.—The Streets and Highways Committee reported that the city surveyor, Mr. P. A. Benn, had called attention to the damage to the roads caused by the motor-omnibus service of the North Warwickshire Motor Omnibus Company. The whole of the roads along their route in the city showed signs of damage, and while he did not suggest that the omnibus company were wholly responsible for it, he did say that they were the worst offenders. It was decided to issue the necessary licences to the company without prejudice to any claim for damage to the roads.

Shoreham U.D.C.—With regard to the repair of certain roads which had been seriously affected by extraordinary traffic, the agreement with the Road Board was approved. The board would be paying two-thirds of the cost, it was stated, and Shoreham's share would be £1,392, which they could borrow and repay in five years. Every half-year £139 would be repaid, and the first half-yearly instalment had been included in the present 1s. rate. This was appreciably below the average cost of the upkeep of these roads, and one member remarked that they had made a splendid bargain.

Steyning West R.D.C.—The clerk, Mr. A. Flowers, made a statement upon the legal position respecting dangerous corners on the Coombes road. The council could purchase a sufficient portion of the land to round off the corner, if they could come to an agreement with the landowner. If unable to arrive at an agreement, they would have to apply, he thought, to the Local Government Board, to put in force sec. 95 of the Public Health Amendment Act, 1907. They had applied for power to put into force certain sections of that Act, but, unfortunately, not that particular section. If they had that section in force it would enable them to get a Provisional Order and obtain compulsory powers. It was decided to apply for the section to be put in force in the rural district. It was also decided to negotiate with the Lancing College authorities, who are the owners of the land, with a view of being able to acquire a portion to round off the corner.

Stockport T.C.—Correspondence has taken place between the deputy borough surveyor and the surveyor to the Hazel Grove and Bramhall Urban District Council (Mr. G. S. Doncaster) relative to the district council's alternative proposal for obtaining an outlet on to Buxton-road for the new 60-ft. road from Marple by way of Gipsy-lane and Nangreave-lane, and the deputy borough surveyor has been authorised to approach the landowners interested, with a view to the requisite land being given for the purpose.

Widnes T.C.—It has been agreed to carry out the extension of Stewards-lane to Deacon-road, and thence by Frederick-street, as well as the widening of Lower House-lane from Stewards-lane to Moor-lane.

Worthing T.C.—The council have approved the second of three alternative schemes prepared by the borough surveyor, Mr. F. Roberts, for the widening of South-street and Montague-street, showing part of Montague-street with a width of 50 ft. and South-street a similar width, with 764 sq. yds. of surplus land for disposal.

SEWERAGE AND SEWAGE DISPOSAL.

Battle U.D.C.—An intimation has been received from the Local Government Board that they would direct an inquiry to be made into the council's application for permission to borrow £950 for works of sewage disposal. They added that the board might not sanction the loan at the present time.

Beverley R.D.C.—The Local Government Board have approved the council's scheme of sewerage for Ellerghton and Brantingham as generally satisfactory, but have postponed sanctioning a loan for the work.

Braintree U.D.C.—It has been decided to extend the Chapel Hill sewer as far as the Clock House on the Cressing-road, where new houses are being built.

Bury T.C.—Major Davoren, in submitting the report of the Public Health Committee, said that they had for some time been trying to bring the sanitary condition of the town up to the standard it should be, and remove the slur cast upon it by the inspector who visited the town. They were not going with a rush, but taking it up piecemeal. They had brought to the notice of certain persons the insanitary condition of lavatory accommodation at various places of public entertainment, and were taking these in hand before dealing with private dwellings. There were also sanitary matters concerning public-houses which they had asked to be remedied, and it was hoped the owners would carry out the necessary improvements without any further interference on the part of the committee.

Easingwold R.D.C.—Mr. F. G. Fairbank, of the firm of Messrs. Fairbank & Sons, engineers, of York, reported that the Stillington sewage scheme was now satisfactorily completed. He had made an inspection of the work, and found the sewage flowing freely into the Foss through the new sewers. There were no signs of sewage deposited at the mouth of the outfall sewer into the Foss, and the ditch near the back entrance to the hall was clear of any sewage deposit. From this it would appear that the new scheme had entirely achieved its object.

Milnrow U.D.C.—The surveyor, Mr. R. R. Jones, has received instructions to prepare a scheme for sewer extension at Birch Hall Brow.

Romford U.D.C. — A sub-committee has been appointed to confer with a committee of the rural district council with a view to an improvement being effected in the discharge of the surface-water drains at the extreme boundary of the district.

Sedgefield U.D.C.—A drainage scheme, estimated to cost £900, is to be carried out in the churchyard.

WATER, GAS, AND ELECTRICITY.

Castletown R.D.C. The council have accepted the tender of Mr. P. H. Nugent, Barby, for the lighting of the town by electricity.

Cavan U.D.C.—Messrs. Swiney & Croasdaile, waterworks engineers, submitted a report stating: "As you are doubtless aware, the detective meter has been installed, and we have had some charts taken off by Mr. Maxwell to indicate the consumption and waste in town, and these reveal a rather startling state of affairs. The last chart showed that the total consumption is 151,600 gallons per day, of which 116,400 gallons is absolute waste. In other words, the rate of consumption for all purposes is 11·7 gallons per head per day, and the water lost is 38·8 gallons per head per day. The consumption agrees fairly well with what we have found to exist in other towns similarly situated, but the waste is far in excess of what it should be, and points to great carelessness in the use of the water in town, with possibly some serious leaks in the mains themselves. This shows more forcibly than any words of ours the necessity for tackling this part of the work with energy and determination, ascertaining where the waste occurs, and putting a stop to it." They advised the appointment of a water inspector, and notice of motion to appoint such an officer was given for discussion at the next meeting.

Dunfermline T.C.—The Treasury are being asked to sanction a loan of £5,000 for the construction of a new water main to Rosyth.

Kanturk R.D.C.—Subject to the approval of the Local Government Board it has been agreed to accept a loan of £2,300, at 4 per cent, repayable in fifteen years, for the provision of a water supply for Newmarket.

Newton Abbot R.D.C.—The council have completed a water supply scheme for Ilsington and Liverton.

Okehampton R.D.C.—It was reported by the surveyors who are also carrying out the duties of the sanitary inspector during the war that the water supply at Hatherleigh and North Tawton needed "nursing." With regard to Hatherleigh, it was stated that the supply was sufficient for domestic purposes if properly distributed, but the high levels were short, and there was a good deal of water used in washing motor-cars. The clerk, answering a question, said the council could not prohibit or specially charge for the use of water for washing private motor-cars. A case directly bearing on the point had been decided on appeal from

Harrogate, the Court holding that this was a legitimate use for domestic purposes.

MISCELLANEOUS.

Cardiff T.C.—The Watch Committee have received authority to provide an installation of the Gamewell fire-alarm system at the new fire station.

Halstead U.D.C.—The General Purposes Committee reported that the surveyor, Mr. W. A. Nicholson, had purchased a motor bicycle from Messrs. Day Brothers, of Earls Colne, for £26. The chairman explained that it was originally decided that the surveyor should hire a motor cycle, but it was found that it cost £2 10s. per week to hire the machine, and that would go a long way towards its purchase. The committee therefore decided to buy it outright, and that had been done.

Southampton T.C.—It has been decided to purchase an Edison electric chassis at £627 for purposes of a tower wagon; also a motor generator at an estimated cost of £250 for charging the vehicle, upon the understanding that the Electricity Committee would supply the necessary current at 1d. per unit.

Swindon T.C.—The corporate seal has been affixed to three contracts with firms at Gainsborough, Leeds, and Westminster, in connection with the provision of a 30-h.p. experimental engine and locomotive boiler, the fixing of a 5-h.p. De Laval steam turbine dynamo, and the supply and fixing of a testing wheel, with motor, at the engineering laboratories at the technical institute.

FOR OTHER ADVERTISEMENTS
See End of Paper.

CORPORATION OF MADRAS.

SPECIAL WORKS DEPARTMENT.

CONTRACT M & M. No. 29.

CAST-IRON WALL SLUICES.

The Corporation of Madras is prepared to receive Tenders from competent persons willing to enter into a Contract for the supply and delivery of fifteen 3-ft. diameter Cast-iron Wall Sluices, with gunmetal faces, adjustable wedge blocks, pillars and headstocks.

Forms of Tender and Drawing prepared by J. W. Madeley, Esq., M.A., M.INST.C.E., M.AM.SOC.C.E., &c., Special Engineer, Corporation of Madras, may be obtained from the undersigned on payment of 4s. each, which will not be returned.

Tenders, accompanied by a deposit in currency notes or a draft on a Madras Bank of Rs.100, should be sent direct to the President, Corporation of Madras, so as to reach him at or before 12 noon on the 16th day of December, 1915.

Early application is desirable, as only a limited number of particulars will be given out.

The Corporation does not bind itself to accept the lowest or any Tender.

JAMES MANSERGH & SONS,
Agents to the Corporation of Madras.
5 Victoria-street,
Westminster.
October 18, 1915. (2,745)

NORFOLK COUNTY COUNCIL.
TENDERS FOR GRANITE—1916.

The Norfolk County Council invites Tenders for the Supply of Granite for the year ending 31st December, 1916.

Full particulars can be obtained from the undersigned.

Tenders to be delivered not later than the 9th November, 1915.

T. H. B. HESLOP,
County Surveyor.
The Shirehouse,
Norwich.
October 20, 1915. (2,747)

REDDITCH URBAN DISTRICT COUNCIL
Temporary Assistant required during the War in the Surveyor's Department. Must be familiar with Building Construction, Drainage Work, Surveying, Draughtsmanship, and general work of a Municipal Surveyor's Office. Knowledge of Book-keeping and Accounts essential. Applicants must be ineligible for Military Service. Apply, stating age, experience, and salary required, together with two recent copies of testimonials, to Mr. G. W. Hobson, Clerk to the Council, Council House, Redditch. (2,746)

PERSONAL.

Mr. A. W. Lloyd and Mr. H. Moody, surveyors to the Holland County Council, have each been voted a war bonus of £20.

Mr. T. Owen, of Aberystwyth, has been appointed surveyor to the Conway Rural District Council in succession to Mr. T. L. Oliver.

Mr. Percy C. Dormer, surveyor and waterworks engineer to the Chesham Urban District Council, has had his salary increased to £260 per annum.

Mr. H. W. Caddy has been appointed temporary borough surveyor of Lyme Regis during the absence of the borough surveyor, Mr. F. H. McDonnell, on active service.

Mr. W. R. Davidge, district surveyor for Lewisham, has been appointed interim district surveyor for Woolwich under the London Building Acts, on the retirement of Mr. Alfred Conder, district surveyor.

Messrs. A. L. Parker, engineer and surveyor, Oakham, and H. Serridge, town hall, Durban, have been elected members, and Messrs. W. O. Coates, town hall, Buxton, H. Turner, town hall, Kroonstaad, and W. L. Carr, engineer and surveyor, Ruislip-Northwood, associates, of the Royal Sanitary Institute.

Mr. J. P. Bennetts, the Harrow Council's surveyor, is a sad but proud man, a Harrow correspondent tells me (says "The Rambler" in the *Daily Mirror*). His entire department has now enlisted for active service, and he is left deserted in his office. Mr. Bennetts himself would have accepted a commission, and only desisted after considerable persuasion from the chairman of the council, who urged that he still had a duty to the town and that the work of his department must be carried on.

Private Edgar James Edgar, younger son of Mr. James Edgar, of Cronkbourne-road, Douglas, Isle of Man, has, we regret to state, been killed in action in the Gallipoli Peninsula. Private Edgar was just twenty-nine years of age. After completing his education at the Douglas Secondary School, he was articled as a pupil to Mr. A. E. Prescott, then borough surveyor of Douglas and now of Eastbourne. After completing his articles, Private Edgar held several appointments in Canada, and later in the city surveyor's office at Sydney. At the outbreak of war he was an assistant engineer to the Public Works Department, New South Wales. He was appointed Second Lieutenant in the Submarine Defence Force of Sydney Harbour. When the menace of an attack on the harbour was removed he joined the Infantry at Liverpool Camp, Sydney, as a private. He was promoted to Sergeant. Then there came a call for signallers for the operations against the Turks. Edgar once more became a private in order to join the signalling company, and was attached to the 1st Signalling Corps, 4th Battalion, of the Australian Expeditionary Force. Before leaving for the front he married Miss Madge Lalor, niece of a former Speaker of the Melbourne House of Assembly. He sailed for Egypt and then to the Gallipoli Peninsula, where he met his death about August 9th last. He was a keen, all-round sportsman of considerable merit. Private Edgar was by examination a member of the Royal Sanitary Institute, and a member of the Institution of Municipal Engineers.

The council of the Surveyors' Institution have nominated Mr. Howard Martin, past-president, 27 Chancery-lane, W.C., as the representative of the institution on the Tribunal of Appeal, under sec. 176 of the London Building Act, 1894, to fill the vacancy caused by the death of the late Mr. Herbert T. Steward.

OBITUARY.

Mr. J. H. Jevons, borough surveyor of Hertford, died suddenly, we regret to state, on the 13th inst. The funeral took place on Monday last, preceded by a service in St. Andrew's Church, Hertford.

Mr. W. H. Leete, ASSOC.M.INST.C.E., county surveyor of Bedford, died, we regret to state, on Monday, at the age of sixty-eight. He had held the office of county surveyor for over twenty-five years, and had previously been borough surveyor of Luton for sixteen years. In addition to being an associate member of the Institution of Civil Engineers, Mr. Leete was a member of the Institution of Municipal and County Engineers, and a member of the Royal Sanitary Institute.

SOME RECENT PUBLICATIONS.*

STRUCTURAL DESIGN. Vol. II.: The Design of Simple Structures. By H. R. Thayer. Price 16s. London: Constable & Co., Limited.

In this second volume of his work on Structural Design, the author, who is assistant professor of the subject at the Carnegie Institute of Technology, Pittsburgh, Pa., discusses in some detail the design of several ordinary types of structure, commencing with beam bridges and plate girders. Subsequent chapters are devoted to steel viaducts and elevated railroads, simple riveted truss bridges, simple pin-connected bridges, steel mill buildings, high office buildings, miscellaneous building work, and stand-pipes and elevated tanks. In each case the treatment is both practical and mathematical, and the work presupposes that the reader possesses a knowledge of mechanics, stresses, and the mathematics on which they depend. The several chapters are written in a lucid style, which is no doubt the result of the author's experience as a teacher, while a feature of the book is the bibliography and table of references to technical periodicals which accompanies each chapter. Although this second volume is a continuation of that formerly issued, which is assumed to be in the reader's possession, it is capable of independent use, while the two volumes together form a comprehensive work which can be recommended with confidence to those interested in the problems of structural engineering.

PURIFICATION PLANTS AND THEIR OPERATION. By Milton F. Stein. Price 10s. 6d. New York: John Wiley & Sons.

Mr. Stein has prepared an excellent elementary book on the subject of water purification plants and their operation. It is a book which deals not with construction, but rather with the work of filter operation. The first chapter treats of water and its impurities in a very elementary way. This chapter is all too short, and might have been amplified with benefit. The second chapter describes various types of purification plants. It is fairly comprehensive, and most of the important features of typical plants are discussed. Some of the examples chosen are complicated, and they do not in all cases represent the best types of plants now in use. The remaining chapters of the book deal with the general subject of operation, and these chapters are well written, and should prove of material assistance to anyone who has charge of a filter. Greater attention is given to the laboratory work than to the general operation of the filter, however, and in this respect the book may be considered to be somewhat unbalanced. The author has got together a good deal of up-to-date information culled from various sources, and the method of presentation is good. The book can be recommended to all who are interested in the subject of water purification.

MODERN BOILER-ROOM PRACTICE AND SMOKE ABATEMENT. By J. T. Hodgson, A.M.I.MECH.E. Price 3s. 6d. nett. London: The Proprietors of the *Railway Engineer*.

This work forms the ninth volume in the publishers' "Railway series of text-books and manuals by railway men for railway men and others." The management of a modern boiler-room must be directed to the maintenance of both safety and economy, and each of these aspects of the manager's work requires a high degree of skill and intelligent foresight. In both directions considerable assistance may be derived from this volume, for the writer has not only succeeded in his endeavour to treat from an essentially practical standpoint the operation and maintenance of a modern steam generating plant, but he has also shown the intimate connection between the economics of steam production and the problem of smoke abatement. The book concludes with a valuable appendix of practical questions and answers intended to be of service to the reader in aiding him to apply the matter dealt with in detail in the preceding chapters.

TRANSACTIONS OF THE INSTITUTION OF WATER ENGINEERS Vol. XIX., 1914. Edited by Percy Griffith, M.INST.C.E., secretary. London: St. Bride's Press, Limited.

The papers contained in this annual record include those on "The Stockport Corporation Waterworks," by T. Molyneux; "Some of the Characters of Coagulated and Mechanically Filtered Water," by Prof. S. Delépine; "The Continuous Aëration and Filtration of the Water of Public Swimming Baths," by L. Holme Lewis; "Notes on Scraping a 15-in. Trunk Main at Batley," by S. C. Barrowclough; and "The Whitton Pumping Station, Ipswich Corporation Waterworks," by C. W. S. Oldham. The volume also contains other information in regard to the proceedings of the institution during the year.

REPORT OF THE NATIONAL ROAD CONFERENCE AND EXHIBITION, 1915. Price 2s. 3d. post free. London: The County Councils Association.

The National Road Conference and Exhibition which was held last June under the auspices of the County Councils Association are still fresh in the memory of our readers, many of whom will no doubt welcome this permanent record of the proceedings, which not only contains the several papers that were submitted, but also a verbatim report of the discussions that took place. We may recall that the conference was divided into four sections. The first was on the use of tar, pitch and bitumen in the construction and maintenance of roads, while the others were on heavy traffic, road classification, and the reconstruction of roads in Belgium.

THE RAILROAD TAPER. By Lee Perkins. Price 10s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

This book has been prepared in order to simplify the use of a compound transition curve of unusual simplicity, which was devised some years ago by Mr. W. Wood, the chief engineer to the Southern Pacific Railway Company. A brief explanation of the taper is first given, and to this the author adds the solution of all the usual curve problems as applied to tapered curves. The book also contains a number of tables designed to enable the engineer to run in this series of compound curves with the ease of running in a simple curve, and from a single setting of the transit.

DARTMOUTH, TOTNES, AND THE RIVER DART. By J. Lee Osborn. (Cloth, 1s.; paper, 6d.) London: Homeland Association, Limited.

This little guide is issued with the object of encouraging tourists to become acquainted with the charming scenery and historic memories of this, one of the most lovely districts in the homeland. It is divided into two parts devoted respectively to Dartmouth and the lower Dart, and Totnes and the upper Dart, and each contains everything likely to interest the intelligent visitor regarding the history, traditions, worthies, antiquities and literary associations of the neighbourhood with which it deals.

BARNSTAPLE—THE GATEWAY TO NORTH DEVON. By Beatrix F. Cresswell. Price 3d. nett. London: Homeland Association, Limited.

This booklet forms one of the well-known series of inexpensive and concise guides to the interesting towns of the United Kingdom issued by the Homeland Association. It contains a brief though accurate description of the principal features of interest written in a readable and interesting style.

ALSO RECEIVED.

"Records of Meteorological Observations taken at the Observatory, Edgbaston," by A. Cresswell. Price 2s. Birmingham and Midland Institute Scientific Society.

A Glossary of Road Terms (By H. Percy Boulnois, M.INST.C.E., St. Bride's Press, Limited, 24 Bride-lane, E.C., price 2s. nett).—The movement towards standardising the principal roads throughout the United Kingdom has rendered it necessary to correlate the nomenclature of road terms in use in different districts, and Mr. Boulnois has compiled a glossary with the hope that it may form a basis for such a correlation.—*Times Engineering Supplement.*

Post-mortem Praise.—Referring to the encomiums which we recently reported were passed upon a member of the Islington borough engineer's staff killed in action, a Canadian contemporary remarks: "The 'slings and arrows' are directed so fast and furious at the municipal engineer during the time of his ministration upon this mundane sphere that it is refreshing to find him honoured even in death. But it seems hard that a man should have to endure all the bitter things of life and pass out having a tithe of honour only after it is too late for him to know anything about it."

*Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

SHANGHAI MUNICIPAL OFFICERS ON WAR SERVICE.

Up to September 30, 1915, ninety-five members of the staff of the Shanghai Municipal Council had left on war service. The following is a summary of the departments to which they belonged:—

	Officers.	N.C.O's & men.	En route, rank unknown.
Volunteer corps staff	2	—	1
Police ..	6	27	22
Health department ...	1	2	—
Public works department	6	3	2
Electricity department ..	6	5	3
Educational department	1	-	1
Finance department ...	4	—	—
Secretariat	2	—	-
Tax department	—	1	—
	28	38	29

SURVEYORS' INSTITUTION.

The first ordinary general meeting of the session 1915-16 will be held on Monday, November 8th, when the president, Mr. John Henry Hanson, will deliver an opening address.

The chair will be taken at eight o'clock.

OPEN SCHOLARSHIPS, 1916.

Owing to the effect of the war upon the number and standard of excellence of the competitors, the council have decided not to offer the institution scholarships during the coming year, and the usual examination in January will therefore not be held.

SESSIONAL PROGRAMME.

The following papers will, provisionally, be read at the ordinary general meetings held at the institution on Mondays, at 8 p.m., during the first part of the session:—

November 8, 1915, the president's address.

November 22, 1915, "Case Law under the Finance Acts," by E. M. Konstam, barrister-at-law.

December 13, 1915, "English Timber Industries and the War," by M. C. Duchesne (Fellow).

January 10, 1916, "The New Stationery Office," by Mr. R. M. Kearns (Fellow).

January 24, 1916, "Practice in Assessing Dilapidations," by Mr. C. F. Slater (Fellow).

February 7, 1916, "Accepted Principles of Town Planning," by Mr. W. R. Davidge (Fellow).

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

ASSISTANT INSPECTOR OF NUISANCES.—October 23rd.—Exeter City Council. £80 per annum.—Mr. H. Lloyd Parry, town clerk.

ENGINEERING AND SURVEYING ASSISTANTS.—October 25th.—Corporation of Huddersfield. £150 per annum.—Borough Engineer, 1 Peel-street, Huddersfield.

ENGINEER.—October 26th.—North Moor Drainage Board.—Mr. G. Lovibond, clerk, Queen-street, Bridgwater.

FOREMAN MAIN AND WATER INSPECTOR.—November 1st.—Gosport Waterworks Company. £150 per annum.—Mr. E. T. Hildred, waterworks engineer, 4 High-street, Gosport.

DRAUGHTSMAN.—Nigerian Railway. £300—£350.—Crown Agents for the Colonies, Whitehall-gardens, London, S.W.

STEAM ROLLER DRIVER.—Derbyshire County Council. 30s. per week, with 2s. bonus.—County Surveyor, Derby.

QUANTITY SURVEYOR.—Hayes Urban District Council.—Mr. D. C. Fidler, surveyor, Council Offices, Grange-road, Hayes, Middlesex.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

YORK.—November 30th.—Schemes under the Housing and Town Planning Act, 1909, in connection with certain areas within and without the city of York, for the corporation. Premiums, £100, £50 and £25.—Mr. F. W. Spurr, city engineer, Guildhall, York.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

EDMONTON.—October 27th.—For the erection of two temporary ward buildings, for the Board of Guardians.—Mr. J. C. S. Mummery, architect, 13 Fitzroy-square, W.

ROMNEY MARSH.—October 29th.—For the removal of an isolation hospital, for the rural district council.—Mr. W. Lamacroft, clerk, Town Hall, New Romney.

DARTFORD.—November 3rd.—For the erection of seventy-two houses, for the urban district council.—The Surveyor.

EDMONTON.—November 9th.—For the erection of a cleansing station, for the urban district council.—Mr. Cuthbert Brown, engineer.

KILKENNY.—November 30th.—For the construction of a reinforced-concrete bridge, for the Kilkenny and Wexford County Council.—Mr. A. M. Burden, county surveyor, Kilkenny.

WILTON.—For repairs to a bridge, for the rural district council.—Mr. R. A. Skelton, district surveyor, Bemerton, Salisbury.

Engineering: Iron and Steel.

PENRITH.—October 25th.—Tenders are invited for the taking down, removing, and purchase of water-pumping plant.—Mr. G. Wainwright, clerk, Town Hall.

EDINBURGH.—October 27th.—For supplying 400 tons of cast-iron pipes, for the Edinburgh and District Water Trust.—The Engineer, 12 St. Giles-street, Edinburgh.

MANCHESTER.—October 27th.—For the supply and erection of coal-conveying plant, coal hopper, water cooler, two electrically driven circulating water pumps, and turbine-driven boiler-feed pump, for the Electricity Committee.—Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

RATHMINES.—October 28th.—For the supply of a motor generator, for the urban district council.—Electrical Engineer, Electricity Works, Rathmines.

DONCASTER.—October 29th.—For supplying and laying 440 lin. yds. of 6-in. water main, for the rural district council.—Mr. W. R. Crabtree, surveyor, Union Offices, High-street.

MALTON.—October 30th.—For the construction of a reservoir and engine-house, supplying and laying cast-iron pipes, and overhauling pumping plant, for the rural district council.—Mr. J. Hutton, engineer, 89 Westborough, Scarborough.

LONDON.—November 1st.—For the supply of twelve chassis, for the Metropolitan Asylums Board.—Mr. T. D. Mann, clerk, Board Offices, Embankment, London, E.C.

GODALMING.—November 2nd.—For sinking and lining a borehole, for the corporation.—Borough Surveyor.

FRASERBURGH.—November 6th.—For the construction of a corrugated steel and timber lifeboat-house and concrete slipway, for the Royal National Lifeboat Institution.—Mr. J. Wallace Tarras, Town House, Fraserburgh.

Roads.

ROMFORD.—October 25th.—For the supply of granite, for the rural district council.—The Highway Surveyor.

The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

Sewage Treatment by Aëration.

It is satisfactory to find that, although it has been necessary to postpone the works of sanitation to a large extent during the war, scientific investigations in connection with new systems of sewage treatment have been proceeding as usual, at any rate in one direction. We refer to the method known as the activated sludge process of sewage purification, in which, by means of forced aëration, the sludge is rendered "active" or full of nitrifying organisms, which in their turn effect the nitrification of the organic matter in the sewage. It will be remembered that this process was first suggested by Dr. G. J. Fowler, and subsequently developed by Messrs. E. Ardern, M.Sc., and W. T. Lockett, M.Sc., who have given the results of their work in several papers read before the Society of Chemical Industry. The latest of these was published in the Journal of the Society of September 30th last, and gives the results which have so far been obtained in the initial production of activated sludge, the volume of air essential for the successful working of the purification process, and the most advantageous proportion of activated sludge to employ. It will be seen that these investigations are proceeding in an orderly manner. At the outset it was necessary to establish the principle of the process, and, as we admitted at the time, this was undoubtedly done in the preliminary investigations. It then became necessary to ascertain the possibilities of the method from a practical point of view, and for this purpose the questions dealt with in the paper under review are of the utmost importance. In the future we shall hope to hear of investigations into the question as to what form of tank is most suitable for the work, and, most desirable of all, whether the process can be carried out satisfactorily on the continuous principle as well as on the fill and draw method which has been in use up to the present. Meanwhile we have the satisfaction of knowing that the results of the latest work demonstrate that, apart from the use of slurry from percolating filters, the initial production of activated sludge can be facilitated and obtained with considerably less air cost than originally was the case; that under certain controlled conditions the volume of air required may be considerably less than previously estimated; and that there is an economic advantage in employing an increased volume of activated sludge, with special reference to the rate of nitrification. It is important to note that all these results refer to Manchester sewage only, and that they will vary in other places where the sewage is of a different character. The question of the time taken from the commencement of operations for the production of the necessary amount of activated sludge is of importance in all cases of new works, and also in existing works where percolating filters are not in use. The results indicate that in the case of the Manchester sewage a period of four weeks is required before thorough nitrification of the effluent can be secured.

With regard to the volume of air required for the efficient working of the process, it was stated in the earlier papers that, according to calculations which had been made at that time, from 12 cub. ft. to 15 cub. ft. of free air per square foot of tank area per hour would be necessary. As the result of the experiments described in the latest paper, it was found that 6 cub. ft. of air per hour was not only sufficient, but that it did not appear to be beneficial to increase the air supply above this figure, at any rate so far as the conditions of this particular experiment were concerned. Investigations made with smaller volumes showed that 2 cub. ft. per hour was insufficient to maintain proper working conditions, but that the effluents produced with 4 cub. ft. per hour were only slightly inferior to those produced with 6 cub. ft. of free air per hour. The authors rightly point out that the amount of air required to produce adequate mixture of activated sludge or sewage on a practical scale will, of course, depend on the design and depth of the tank. This will be the case to an even greater extent when the process is operated on the continuous principle. It is therefore important to note that, in the estimates of the cost of aëration which are given in the paper, the depth of the tank is taken as 6 ft. In this connection it is interesting to find that by the use of a much larger proportion of activated sludge the total volume of air required is reduced by about 25 per cent. We have previously suggested in these columns the probable importance of this question of the depth of the tank, and for this, as well as for other reasons, we hope that the present investigators will shortly be able to continue their investigations in this direction. We have stated our opinion of the valuable work which is being done by Messrs. Ardern and Lockett, and we need not do more on this occasion than add, in conclusion, that the results set forth in this their latest paper justify the most optimistic opinions which have been held by those who are watching their labours with interest, and should provide every encouragement to them to continue, with the same ability and devotedness as in the past, the work they have so well begun.

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Land Valuation Staff and War Service.

Although the principle of doing evil that good may come is not one which commends itself as a basis of conduct for right-thinking people, it is undeniable that as a matter of experience indirect good does in fact from time to time emerge from an undoubted wrong. A case in point is the sanction which has been given by the Commissioners of Inland Revenue for raising technical units for his Majesty's Forces from among those members of the valuation staff whose services are being dispensed with and from suitable friends introduced by them. The War Office has sanctioned the immediate formation of Royal Garrison Artillery Siege Batteries (Regulars). The men are required to enlist, and may then be sent to their homes under Lord Derby's scheme until there are sufficient to form the first battery, when they will be sent to the various coast defences for training. These siege batteries will eventually be utilised for manning the heavy ordnance in the field. The duties of these batteries are extremely interesting, involving work of a highly technical character, such as mathematical calculations, use of instruments, and mechanical transport, while the rates of pay are such that with allowances a man with dependants is probably in a better position as an N.C.O. than as a second lieutenant, taking into account the necessary expenses which must be incurred by the latter to keep up his position.

The scheme should appeal to all men of the surveying and allied professions who desire to join this arm, as it ensures social intercourse with men they probably know and of their own class. If any should desire to join the first unit, they should obtain an introduction through any past or present member of the Valuation Office, and apply to the District Valuer, Finsbury Park, N., for a preliminary form of application. It is understood that some officers and N.C.O.'s will be required for the units soon after their formation if suitable men can be found among those who join, and there is a probability that an eye will be kept on those who show the most progress with a view to transfer to other units as officers and N.C.O.'s. Mr. Chandler, the district valuer for Islington, from whom the proposal emanates, has been ably assisted by Mr. R. W. Cantlay, F.S.I., District Valuer's Office, Finsbury-square, E.C., in making the preliminary arrangements, and a large number of applications are already to hand. Applications are entered in the same order as received, so that those desiring to join the first unit should lose no time. We commend the scheme to our readers as affording a specially suitable opportunity for obtaining congenial work in the service of King and country.

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Municipal Engineers and the War.

The unique opportunities possessed by the municipal engineer for assisting the military authorities in this country in various ways in themselves afforded sufficient justification—if any were needed—for the subject upon which Mr. S. S. Haywood, the borough engineer of Brighouse, addressed the meeting of the North-Eastern District of the Institution of Municipal and County Engineers held in that town on Saturday last. The title of the paper was "The Duties of a Municipal Engineer in the Present War," and its first theme was that of municipal economy. Many useful suggestions were made in regard to matters of detail, and it would be well if these were generally observed. There never was a time when the old Scottish proverb "Mony a mickle mak' a muckle" had greater application than it has to-day, and for our part we are convinced that rigid attention to what we may call economy in detail would in most districts have an appreciable effect upon the rates. Mr. Haywood uttered a timely word of warning as to economising on main road maintenance, a policy which is apt to prove expensive in the long run both to highway authorities and the owners of vehicles. It must be remembered that the present congestion of our railways, owing to military exigencies, has resulted in a considerable increase in the volume of main road traffic—a fact which renders it more than ever necessary to keep these roads in a state of efficiency.

Dealing next with the direct assistance which the municipal engineer can render to the military authorities, Mr. Haywood suggested that their requirements should, as far as possible, be anticipated. For example, the capabilities of the district for the training of troops and the billeting of soldiers may be studied in advance, so that the surveyor may not be taken by surprise if application is made to him in regard to these matters. Then, again, suitable areas may well be selected for drill, manœuvres, and trench-digging operations, while the actual arrival of the troops will open up innumerable other opportunities for service. Mr. Haywood's final suggestion was that the municipal engineer who is, either by reason of age or other circumstances, unable to join the Army should prepare himself to "do his bit" in the last resort by joining the local Volunteer Training Corps.

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The Progress of Sanitation in War Time.

In this country nearly all works of sanitation which are not required for military purposes are suspended until the end of the war, and those which are being carried out are almost entirely confined to camps and hospitals for the wounded. Every week our columns contain reports of schemes for sewerage and sewage disposal which have been approved by the Local Government Board with the intimation that sanction for the necessary loans will be refused until after the war, the intention being to reduce to the minimum all expenditure on work not essential to the prosecution of the war. In Germany, on the other hand, different methods are adopted. We learn from a letter to *Engineering Record* that Dr. Imhoff, the inventor of the Emscher sewage tank, who has been in France with his regiment since October, 1914, has spent his period of leave in completing designs for a large scheme of sewerage. The writer of the letter, Mr. Rudolph Hering, the eminent civil engineer of New York, further states that he has learnt from other sources that the German Government has been building a large number of Imhoff tanks as a part of its general works of sanitation in the cities of Belgium and Northern France occupied by the German Army. As there are few towns in this region which possess proper systems of sewage disposal, there was room for improvement in the direction indicated, but it will be a curious state of affairs if the German occupation of this territory should prove to have been beneficial in this one respect when our Allies regain their temporarily lost province. There is also the question of patent rights in connection with these sewage tanks. Information on these points will be extremely interesting when it becomes available later on. Meanwhile it would appear that the postponement in this country of a large number of schemes of sewerage and sewage disposal for the time being must result in a large amount of work being put in hand when the war is over, and this should assist in reducing the unemployment which will undoubtedly exist at that time.

* * *

Local Authorities and Recruiting.

A circular has this week been issued by the Local Government Board urging local authorities to do all in their power to assist the work of the local recruiting authorities in con-

meet in with what has come to be known as Lord Derby's scheme. That this appeal will meet with a ready and willing response goes without saying, but the *modus operandi* suggested is not without interest. It is inevitable under the scheme that questions will arise in individual cases as to the desirability of enlistment both in the case of "starred" men who wish to join the Army and also in the case of men not "starred," but whose special skill and knowledge render them indispensable to the trades and undertakings in which they are employed, and upon whose technical capacity the working of some industry may hinge. It is suggested that these cases should be adjudicated upon by specially constituted local tribunals to be appointed by the local authorities. It is pointed out that the committee should be a small body and, unless there are special reasons, such as the size of the district, should generally not consist of more than five members. Having regard to the functions of the committee, the importance of appointing men of impartial and balanced judgment is very properly emphasised. Moreover, the committee need not be confined to members of the council, and the appointment of persons from outside their own body will in most cases be desirable. The recruiting officer in the locality will not be a member of the committee, but he or someone on his behalf should be present at the hearing of all cases, and he will have the right to appeal against any decision to a higher tribunal. It is hoped that by the exercise of tact and by a general understanding all men who can possibly be spared will be spared, and that such cases of reference will be very limited. It is proposed that an appeal should lie from the decision of the local committee to a district tribunal, of which a few, each having jurisdiction over a wide area, will be appointed. The whole of the work will be under the direction of a central committee.

* * *

Manchester Sewage Disposal.

The annual report for the year ending March 31st last, issued by the Rivers Department in the city of Manchester, contains the usual well-arranged report upon the work of the preceding year. The results show that while the population connected to the sewers has increased by a little over 10 per cent, the total cost per head of the population, including capital and maintenance charges for sewage disposal, has been reduced by about 8 per cent—*i.e.*, from 24·2d. for 1914 to 22·2d. for 1915. On the other hand, the percentage of purification of the raw sewage as measured by the four hours' oxygen absorption test, and also by the albuminoid ammonia test, has dropped by about 8 per cent. The special research work which has been carried out at the Manchester sewage works for some time was described in a paper which was read by Messrs. Ardern and Lockett before the Society of Chemical Industry in November, 1914, and it has already been dealt with in these pages. Since that time satisfactory progress is being made in further investigations in several directions, but as the work was incomplete at the end of the period dealt with in this report, the detailed results will be given later. Particulars are also given of the Emscher tanks which have been installed at the Withington sewage works and have been in operation since August, 1914, but it was considered desirable to defer the publication of the chemical and bacteriological results to a future report.

* * *

Road Tarring Statistics.

A very useful outcome of the recent meeting of the Eastern Sub-District of the Institution of Municipal and County Engineers at Cromer has been the tabulation of the replies received from members to questions issued by the honorary subdistrict secretary in regard to the cost of road tarring. In addition to giving bare answers to the questions submitted many of the members supplied most valuable information of a general nature. For example, Mr. A. E. Collins, of Norwich, expresses the opinion that the effect of tar-painting on his roads, which can dry in a reasonable time, is to apply a new face to the road yearly, which in many cases lasts for a year; where it does not he endeavours to patch the road before applying a new coat. One of the questions asked was as to the number of square yards covered by a gallon of tar, and in regard to this Mr. J. W. Walshaw, of Peterborough, points out that the area varies according to the condition of the road. Thus, a road which was treated a year ago, and which has not been repaired in the meantime, takes much less tar and chips than are required for a newly repaired road. It must be borne in mind that tarring is an operation in which present expenditure is justified by future saving. Thus, Mr. Cockrill holds the view that if a macadam road in good condition is treated in this way the life of the road will be doubled, while considerable additional saving will be effected by a substantial reduction in the cost of cleansing.

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The Lilian Bradshaw Fund.

It affords us great pleasure to acquaint our readers with the fact that the generous interest taken in the case of Mrs. Lilian Bradshaw, on whose behalf an appeal was made in these columns some weeks ago, has resulted in the raising of a total sum of £50 5s. 6d. This amount, which includes a grant of £15 from the Orphan Fund of the Institution of Municipal and County Engineers, has been of the greatest possible assistance in meeting Mrs. Bradshaw's immediate necessities, and she now desires to express her grateful thanks to all those who have so readily responded to the appeal. If there are any others who are desirous of contributing to the fund, we would suggest that they should forward their gifts to Mr. O. Claude Robson, the hon. secretary to the Institution Orphan Fund. It has afforded us satisfaction that we have been able to render some small service in connection with this matter, and if, as we venture to hope, the publicity which has been given to the circumstances of this sad and deserving case—which is by no means unique in consequence of the low salaries paid to many surveyors—results in some accession to the rank of the regular subscribers to the Orphan Fund, we shall feel amply rewarded for our efforts.

Professional Classes War Relief Council. — Our readers will be aware of the good work done by this body. Funds are fully needed, as although the council is receiving official support, the Cabinet Committee makes it dependent upon equal funds being obtained from private sources. It is therefore proposed to hold a great Christmas in Wartime Sale at the Albert Hall, under the patronage of H.M. the Queen, H.M. Queen Alexandra, and other members of the Royal Family. In order to secure the interest of the different professions, separate committees, representing doctors, lawyers, architects, and others have been set up, including a Surveyors' Committee, composed of representatives of the Surveyors' Institution, the Auctioneers' and Estate Agents' Institute, the Land Agents' Society, and the Quantity Surveyors' Association. At the first meeting of the Surveyors' Committee, the hon. secretary of which is Mr. A. Goddard, secretary to the Surveyors' Institution, it was decided that each society should circulate particulars of the sale among all their members with a view to interesting them and their families in securing articles for the sale, and disposing of tickets and thus insuring a good attendance. Mr. Goddard informed the committee of the steps he had already taken to bring the matter to the notice of members of his institution, and particularly of the efforts made to secure the co-operation of the provincial committees. It was decided that other societies should be asked to act on similar lines.

Construction and Maintenance of Rural Highways.*

By ALFRED DRYLAND, M.Inst.C.E., County Surveyor of Surrey, England; Member of the Advisory Engineering Committee of the Road Board.

The author's practical experience in the construction and maintenance of roads has been entirely gained in England. During the past twenty-five years he has been successively assistant county surveyor of Kent, and county surveyor of Herefordshire, Wiltshire and Surrey. The first and last counties are suburban in parts bordering on the Metropolis; the two intermediate counties are almost entirely agricultural. During the six and a-half years the author has been in Surrey the automobile traffic has immensely increased, and now forms by far the larger percentage of the traffic. In some cases the horse-drawn vehicles only amount to 13 per cent in number and 7 per cent in weight of the total of the two kinds of traffic.

As weather influences form such a large factor in the durability of all kinds of road surfaces, it is desirable that Congress should be reminded of the conditions that obtain in this country. The average rainfall varies in different parts of the country from 20 in. to 35 in. (50·88 cm.), but rises to about 75 in. (187 cm.) in the mountainous portions. The general average over the greater part of the country is probably round about 28 in. (70 cm.); measurable rain falls on about 180 days in the year, there being a large proportion of days when the roads remain damp in consequence of the humidity of the atmosphere. The roads are generally bordered by hedges and trees, which tend to encourage dampness by excluding sun and wind.

The temperature ranges from 135 deg. Fahr. (57·2 deg. Cent.) maximum sun heat on road surface to a minimum of about 14 deg. Fahr. (-10 deg. Cent.), or a range of approximately 120 deg. Fahr. (48·8 deg. Cent.). Hard frosts are seldom of long duration, but for the five months from November to March morning frosts and subsequent thaws, often attended by slight rain, bring about very unfavourable conditions for maintenance. At rare intervals frosts of several weeks' duration are experienced, but for the last few years the winters have been of a generally mild character.

For the better understanding of English conditions the author desires to point out that, owing to the very complete network of highways existent in all parts of the country, there is very little new construction of rural roads, except such as arises from the development of new centres of population. Almost all the main traffic arteries consist of the old turnpike roads which were either newly formed between 1730 and 1840, or improved from previously existing highways during that period. The general formation of these roads consists of an aggregation of gravel or broken stone on the natural soil, except in districts where granite, limestone, or sandstone rocks prevail, where pitched foundations obtain. The thickness of the crusts varies considerably, according to the nature of the subsoil and the traffic conditions to which they have been subjected, but in general terms they may be said to range from 6 in. (15 cm.) on chalk and dry gravel to 15 in. or 18 in. (37 cm. or 45 cm.) on the clay and other wet soils. Where pitching exists it ranges in thickness from 4 in. (10 cm.) to 9 in. (22 cm.). From a considerable experience of maintenance on both kinds of foundation the author prefers for general stability the pitching method to the macadam aggregate, although, with adequate side support, the latter is found to afford a quite satisfactory base for all but the very heaviest traffic conditions.

The district or branch roads are very similar to the main traffic arteries, except that pitching is seldom found, as their growth from tracks to hard-metalled roads has been of a more haphazard character than in the case of the old trunpikes, and the thickness of road crust is seldom as great.

Construction of Rural Highways.

Very little change has been made in recent years in the methods of constructing new roads, except to provide a somewhat greater depth of foundation. The general practice after grading the soil bed is to lay "hard core," composed of old concrete, hard burnt-brick rubbish, or rubble stone, and consolidate by rolling to the required thickness, which ranges from 6 in. (15 cm.) to 12 in. (30 cm.), according to the nature of the subsoil and the traffic to be expected. The former thickness is often considered sufficient on chalk or dry sand or gravel, and the latter is used on clay and wet soils, where the bottom 3 in. (7½ cm.) is often composed of ashes, which is found useful to form an absorbent base and to prevent clay from being squeezed up among the hard core in the process of rolling.

Where clean ballast is available at a reasonable price it would probably be found cheaper to form a Portland cement-concrete base, and in the author's opinion the tendency will be in that direction. In suburban districts this has been done in a few cases, and quite recently some reinforcement of the wire-mesh type has been used. The concrete method of foundationing is, in the author's opinion, preferable to the hard-core method where a tar-macadam or bituminous paving is to form the surface, provided a sufficient thickness of pavement is laid to permit of some resilience.

For water-bound surfaces, 6 in. (15 cm.) is the usual consolidated thickness of metal imposed upon the foundation course, the bottom 3 in. (7½ cm.) being generally of an inferior material to the wearing surface.

Nearly all newly formed water-bound roads are now surface dressed with hot tar and chippings, or coarse sand on completion. Two dressings are generally given the first year and one in succeeding years during the life of the coating.

For roads required to sustain a great deal of motor traffic, tar-macadam is generally used for the surface, in which case the thickness is not less than 3 in. (7½ cm.), but preferably 4 in. (10 cm.). The most satisfactory material for the purpose is blast-furnace slag, as it has the property of forming a homogeneous mass, retains its life, and forms a very waterproof and durable wearing surface. The gauges generally employed are 2½ in. (5½ cm.) for base, 1½ in. (3¾ cm.) to ½ in (1¼ cm.) for topping, with a little ½ in. (1¼cm.) as filling material. An alternative method is to lay the main coating of mixed grades from 2½ in. (5½ cm.) down to ½ in. (1¼ cm.), with a little ⅜ in. (·95 cm.) to fill the voids. For 3 in. (7½ cm.) pavements the author prefers this method, but for 4 in. (10 cm.) the former.

Limestone tar-macadam on the same system of laying has been largely used, and where the situation is well exposed to quick drying influences has been found very successful provided the traffic is not too heavy.

Granite tar-macadams have also been largely used, but the results, on the whole, have not been satisfactory, the failures far exceeding the successes. It is far more susceptible to sun heat than the slag or limestone, permitting considerable movement under heavy wheels in summer, and it is far from waterproof in winter. Its use in any but exposed situations and under quite light traffic the author considers will lead to disappointment; at any rate, that has been his experience, based on a great variety of instances.

To a very limited extent, pitch-grouted granite has been used as an alternative to tar-macadam, but the tendency to corrugate in hot weather is a great drawback to this method of construction. In the author's opinion this is due to the excessive amount of matrix used to fill the voids, notwithstanding which it is difficult to secure complete waterproofing in winter, and an irregular texture of surface is often experienced in consequence of a perfectly regular distribution of the matrix not always being obtained. The author ventures to suggest that the method is crude in its execution and uncertain in results, and will not survive in the march of progress.

Another method adopted, more particularly in districts where horse traffic is in the ascendant and on steep gradients, is the use of binders for macadam of the nature of slow-setting cements, such as Rocmac, Ferromac and Vianex. These meet with considerable favour in the Midlands and the North, and undoubtedly serve a useful purpose in holding the material firmly in place, thus lengthening the wear of the macadam. The road produced is, however, by no means free from dust, and palliatives have to be used where the automobile traffic is appreciable.

For the heaviest class of traffic, and particularly

* Paper submitted to the International Engineering Congress at San Francisco.

[illegible] durability of this form of construction is expected to be great. The drawback appears to be the liability to slight surface corrugations of the nature of short waves or ripples.

WIDTH OF CARRIAGEWAYS.

There is a general tendency to increased width, as it is found desirable to enable the traffic to distribute itself over the full width of the road.

Taking the English Road Board forms as a basis for instances of traffic, the following widths are found the most suitable for main arteries in country [illegible]:—

Up to 3,500 units per day of sixteen hours (approximately 170,000 tons per yard width per annum), 30 ft. (9·12 metres).

Up to 2,500 units per day of sixteen hours (approximately 150,000 tons per yard width per annum), 24 ft. (7·29 metres).

Up to 1,000 units per day of sixteen hours (approximately 50,000 tons per yard width per annum), 21 ft. (6·38 metres).

Up to 700 units per day of sixteen hours (approximately 38,000 tons per yard width per annum), 18 ft. (5·47 metres).

The author is strongly of opinion that the latter width is the minimum required for any considerable automobile traffic, but for branch roads carrying only a small amount it may be reduced to 14 ft. (4·25 metres). Narrow carriageways tend to undue wear by tracking of the centre portion, a form of wear which it is very difficult to satisfactorily repair.

CAMBER.

The latest practice in this respect is to keep the cross-fall as little as possible, to enable the full width of road to be used. Cross-falls range from 1 in 28 to 1 in 36, according to the relative smoothness of surface of the coating material, the latter grade being used for asphaltic surfaces.

MAINTENANCE OF EXISTING HIGHWAYS.

In this country, with its complete network of roads existing before the advent of self-propelled traffic, the question of maintenance has always been the most important one, and has resulted in many progressive changes. From the passing of the first Motor Car Act in 1896, legalising the lighter form of self-propelled vehicle, there was a steady, but slow, growth of this kind of traffic; but it did not become sufficiently great to cause any extensive trouble until about 1903, when tracking, potholing, and general disintegration of surface became a serious factor, and the dust nuisance caused a great outcry. This led to the adoption of surface treatment with tar and similar compounds, which undoubtedly resulted in the practical abolition of the dust nuisance in its acute form, and also in its result lengthened the durability of the water-bound coatings. Up to the present day, on sound crusts in fairly dry situations, a water-bound macadam road surface tarred each year is found to be the most economical and satisfactory form of road where the traffic does not exceed a maximum summer traffic of about 1,300 units, or, say, 1,200 tons per day, and a winter traffic of about 60 per cent of this maximum on a 20 ft. (6 metres) width of carriageway. In a situation which is permanently damp throughout the winter months this limit may prove somewhat too high to give satisfactory results, as, ere the winter is over, the tarred surface becomes practically destroyed, and before the weather becomes sufficiently dry to enable retarring to take place the disintegrating effects of traffic on the damp surfaces are rapid. This is particularly so if there is any large proportion of rubber-tyred heavy vehicles, such as motor 'buses or lorries.

The general tendency of road maintenance on rural highways during the last ten years has been to change the surfaces in the following order, according to the severity of traffic conditions:—

(1) Substitution of the hardest granites for limestone and flints on water-bound roads.

(2) Surface tarring.

(3) Tar-macadams composed of blast-furnace slag, limestone, and granite and cementitious binders, such as Rocmac, Ferromac and Vianex, or pitch-grouted granite.

(4) Asphaltic carpet coats, 1 in. to 1½ in. (2·5 cm. to 3·8 cm.) in thickness, on existing water-bound macadam base.

(5) Two-course pavements of tar, pitch or bituminous macadam base with 1 in. (2·5 cm.) carpets of asphaltic facing material thereon.

The large growth of the heavier class of motor vehicle, such as the 5-ton lorry, the 'buses, and delivery vans, during the last three or four years has rendered the difficulty of maintenance much greater. When these units reach an appreciable proportion of the traffic, water-bound macadam, even if surface tarred, soon becomes distorted, and its renewal is practically impossible, as new coatings are corrugated before the water used in consolidation has dried out. The two-course pavement with asphaltic carpet is now being largely adopted on important roads to meet this condition, and especially on country motor-'bus routes. One-course asphaltic macadams have been tried, but in few cases have they had a long life under heavy traffic, as the winter traffic tends to unseal the surface to some extent and gradual disintegration follows.

Some of the county councils and the larger town authorities have recently established their own plants for the manufacture of bituminous macadams and asphaltic carpets. Among the chief reasons instigating this departure was the difficulty of getting repairs, such as small patchings and trenchings, made good at a reasonable price. In many cases, too, there are local supplies of suitable sands available which can be utilised in the manufacture of asphaltic materials and conveniently distributed from local centres by means of petrol-driven motor lorries. Moreover, the men engaged in this work can be found employment during the winter months on other work in connection with roads, an advantage which is not always open to the contractor, who either has to retain men whom he cannot profitably employ or run the risk of losing them when the season for asphaltic work comes round again. It is expected that the larger authorities will be able to effect a considerable reduction in the cost of paving works for these reasons.

The lateral retention of road crusts has, during the last year or two, become a pressing question, owing to the heavier vehicles largely keeping to the sides of the roads to avoid the continual pulling in for faster vehicles to pass. On country roads bordered only by grass margins it has been found that the crusts tend to push out into the margin. Such margins have always proved an unsatisfactory finish for bituminous coatings, and this has led to the more important lengths being kerbed with granite kerbs bedded on concrete. The author has lately adopted a continuous reinforced in situ submerged concrete kerb for the purpose of affording support to road crusts where bituminous pavements are being laid. These kerbs are of a minimum depth of 9 in. (22½ cm.), and width of 4 in. (10 cm.), and are reinforced with two rows of ¼ in. (·63 cm.) steel rods. The top edge of the kerb is set at the proper level to form the abutment to the face of the asphalt or tar-macadam coating. With cement at 38s. ($9.12) per ton, ballast about 7s. ($1.68), and labour averaging about 4s. 6d. ($1·08) per day, the cost complete works out at about 18d. (36 cents.) per yard-run, or the equivalent on a 8-yd. (7·2 metres) width of carriageway, of about 5d. (10 cents.) per yard super.

The author suggests this method of retention is particularly valuable where the road consists only of macadam aggregate without any supporting pitching or thrust blocks.

SMALL REPAIRS.

The author finds that prompt and skilful attention to small surface repairs is becoming more and more important as automobile traffic increases. It is most necessary to secure the prolonged life of pavements.

In this country it is customary to have what is known as a "lengthman," who has charge of from 2 up to 5 miles (3·2 k. to 8 k.), according to the importance of the road. His duty is to keep his length neat and tidy, and execute small patching repairs directly a slight defect appears, for which purpose he is kept supplied with suitable patching materials. All patches have to be neatly cut out to a sufficient depth to permit of a proper key being obtained, and the material is consolidated with a rammer or hand-roller.

Single-deck Motor 'Buses in Brighton.—For some years the traffic requirements in the hilly districts of the town and residential suburbs have presented various difficulties. The heavy cost of working either trams or 'buses on these routes has rendered the traffic unremunerative. An experimental service with single-deck motor 'buses initiated a few weeks ago has (says the *Daily Telegraph*) proved so successful that it is now being developed, and it is expected that it will solve the problem.

The Oxidation of Sewage without the Aid of Filters.*

PART III.

By E. ARDERN, M.Sc., and W. T. LOCKETT, M.Sc.

In the concluding paragraphs of a paper presented to this section of the society in November last it was stated that attention was being devoted to certain factors controlling the activated sludge process of sewage purification, which has been developed by the authors.

It is proposed in the present communication to give the results which have so far been obtained in regard to—

(1) The initial production of activated sludge;
(2) The volume of air essential for the successful working of the purification process;
(3) The most advantageous proportion of activated sludge to employ;
together with a description of certain experiments relating to the purification of a dilute domestic sewage.

(1) PRODUCTION OF ACTIVATED SLUDGE.

In the original experiments described in Part I. of this series of papers the activated sludge was obtained in the following manner: Manchester sewage was continuously aërated until complete nitrification ensued. At the end of this period the clear oxidised liquor was removed by decantation and a further sample of raw sewage aërated in contact with the original deposited matter until the sewage was again completely nitrified. This method of treatment was repeated a number of times, with the retention in each case of the deposited solids. Working in this manner, it is obvious that a considerable amount of time must elapse before a quantity of activated sludge has accumulated sufficient to deal effectively with the sewage, with consequent considerable expenditure of air in proportion to the volume of sewage dealt with in the meantime. The time required for the production, by this method, of an effective quantity of activated sludge will vary naturally with the character and composition of the sewage dealt with. In the case of Manchester sewage, the production of an adequate supply of sludge requires a period of at least six months.

As noted in Part II. of this series of papers, slurry or humus from efficient percolating filters forms a good starting point for the rapid production of activated sludge. On aërating such material in contact with raw sewage, an initial deflocculation effect is observable. Within a reasonable period of time, dependent upon the state of oxidation of the slurry, nitrification of the sewage is obtained, and after dealing with a few successive volumes of sewage, under favourable temperature conditions, the slurry becomes thoroughly activated and capable of producing well clarified and highly nitrified effluents.

In connection with the use of slurry it is important that it should be, as far as possible, free from grit, &c., resulting from the disintegration of the filtering media, which is liable to cause difficulty in connection with the circulation of the activated sludge.

As this method of producing activated sludge only applies where percolating filters are available, it was important to investigate the possibility of accelerating the rate of production of activated sludge from the sewage *per se*.

Quite early in the course of the investigation of the activated sludge method of purification of sewage it was observed that a sludge capable of effecting satisfactory clarification of sewage and of promoting a vigorous carbonaceous fermentation could be produced by subjecting successive volumes of sewage to periods of aëration not exceeding forty-eight hours. It appeared from these early experiments that possibly nitrifying power could be imparted to this partially activated sludge, and although the difficulty of establishing healthy growths of nitrifying organisms in the presence of excessive quantities of nitrogenous organic matter was known, this question seemed worthy of investigation.

The possible means of rendering partially activated sludge completely active were first of all studied in the laboratory. Under suitable temperature conditions it was found that this could be effected by treatment of the sludge with successive volumes of sewage which in each case were aërated continuously until complete nitrification was obtained.

Table I.—Manchester Sewage.
Results in parts per 100,000.

	Period 1. Aeration—21 hours.			Period 2. Aeration—9 hours.			Period 3. Aeration—6, 6, and 4 hours.		
	Raw sewage.	Effluents obtained using:—		Raw sewage.	Effluents obtained using		Raw sewage.	Effluents obtained using:—	
		Diffused air.	Plain pipe aëration.		Diffused air.	Plain pipe aëration.		Diffused air.	Plain pipe aëration.
Four hours' oxygen absorption	1·867	·327	·373	10·76	2·13	2·44	12·27	2·26	2·99
Free and saline ammonia ...	·744	·334	·340	3·86	2·86	2·93	3·67	3·50	3·34
Albuminoid ammonia ...	1·19	·0335	·039	0·94	0·17	0·24	1·07	0·24	0·33
Suspended matters —									
Mineral ...	13·1	1·1	1·6	6·6	1·0	1·4	8·6	0·6	1·6
Organic ...	15·6	0·7	1·8	10·3	0·6	1·8	12·9	0·7	2·4
Total ...	28·7	1·8	3·4	16·9	1·6	3·2	21·5	1·3	4·0

With a view to obtaining reliable quantitative data in regard to the time required to produce activated sludge in bulk by this method, and also to determine the total sludge production from a given volume of sewage, a carefully controlled outdoor experiment was carried out on similar lines. For this purpose two 50-gallon casks were employed, similar to those used in the outdoor experiments described in a previous paper. The two casks were subjected to similar working conditions, except as regards the means of aëration. In the one cask the air was admitted through a porous tile of 1 sq. ft. area; in the other cask aëration was effected through a plain pipe. The bottoms of the casks in each case were so constructed as to ensure complete admixture of the accumulated sludge and sewage.

For the production of partially activated sludge the casks received in the early stages one filling of raw sewage per day—twenty-one hours' aëration and two hours' settlement being allowed—for twelve successive days. At the end of this period sectional samples showed that clarification of the sewage could be obtained with a reduced aëration period. Accordingly the period was reduced from twenty-one to nine hours, the casks thus receiving two fillings per day. Shortly afterwards the casks were operated in the following manner:—

Filling.	Aeration period.	Settlement.
7.0 a.m. 2.0 p.m. 10.30 p.m.	7.0—11.0 a.m. 2.0—8.0 p.m. 10.30 p.m.—4.30 a.m.	11.0 a.m.—1.0 p.m. 8.0—10.0 p.m. 4.30—6.30 a.m.

* From the Journal of the Manchester Section of the Society of Chemical Industry, September 30th last.

Throughout the above operations three-fourths only of the total contents of the casks was removed at each discharge.

Working in the manner described, in twenty-six days each cask, having received forty-eight fillings, had dealt with approximately 1,600 gallons of sewage, and the volume of sludge accumulated, measured after two hours' settlement, was equal to 18·6 per cent of the total contents of the cask. Determinations of the suspended matters of the sewage dealt with and of the resulting effluents showed that the amount of sludge obtained was practically equivalent to the suspended solids removed from the sewage.

At this point it was considered advisable to commence the complete activation of the sludge accumulated.

In Table I. are given the results of the treatment of sewage during this initial accumulation of partially activated sludge.

In connection with the complete activation of the sludge, accumulated as described previously, owing to the fact that excess of air was employed in each case, little difference was observed in the results obtained with the two methods of aëration employed, and accordingly the account of this part of the work is confined to the experiment using diffused air.

For this conversion the partially activated sludge was continuously aërated in contact with sewage until nitrification was complete. The first volume of sewage thus dealt with required a period of fifteen days.* During this interval there was initially a definite nitrogenous fermentation of the partially activated sludge, as indicated by a considerable rise in the free and saline ammonia content, as will be seen from the following analytical returns of samples taken periodically.

TABLE II.

Results in parts per 100,000.

—	Raw sewage.	After 5 days' aeration.	After 7 days' aeration.	After 12 days' aeration.	After 14 days' aeration.
Free and saline ammonia	2·00	7·28	8·86	6·70	1·80
Nitrite and nitrate in terms of NH_3	–	0·40	0·57	5·76	12·86

The nitrated effluent resulting from the above treatment was removed by decantation and replaced by a further volume of raw sewage. Three days' continuous aëration was sufficient to complete the nitrification of this volume of sewage. No evidence of ammoniacal fermentation of the sludge was observed during this period. Repeating this method of operation, it was found that a succeeding volume of sewage was fully nitrified in about twenty-six hours, and subsequently the aëration period required for further volumes of sewage was reduced, with the result that within a period of four weeks from the commencement of the complete activation of the sludge, entirely satisfactory results were obtained with an eight hours' aëration period. Shortly afterwards the aëration period was further reduced to six hours.

Once having obtained the sludge in a state of complete activation, the volume of which amounted to 25 per cent (measured after two hours' settlement), an endeavour was made to determine the amount of sludge resulting from the treatment of a definite volume of sewage, and also to follow the question of the nitrogen content of the sludge in relation to the total nitrogen content of the sewage.

At the commencement of the experiment a careful determination was made of the volume of sludge and of the amount and character of the solid content. The cask fitted with the diffuser was then continuously operated over a period of seven days. Aëration periods varying from six to eight hours were found sufficient to produce well-nitrified effluents with a very low free and saline ammonia content. At the conclusion of this period of working, the volume and character of sludge were redetermined. The whole of the data thus obtained are given in Table III.

* In this case, to obtain a completely nitrified effluent it was necessary to add quantities of alkali (Na_2Co_3) from time to time as required.

TABLE III.—SLUDGE PRODUCTION—MANCHESTER SEWAGE.

Results in parts per 100,000.

—	Raw sewage.	Effluent.
Average total solids	109·0	74·0
In suspension	23·7	2·0
In solution	85·3	72·0
Organic nitrogen (Kjeldahl)	1·72	0·25

—	At commencement of experiment.	At end of experiment.
Volume of sludge (after two hours' settlement)	25·0 per cent	14·0 per cent
Sludge in cask	52½ litres	88½ litres
Water content	97·6 per cent	97·6 per cent
Specific gravity	—	1·009
Weight of dry matter	1,291 grm.	2,147 grm.

Total volume of sewage dealt with =1,558 litres.

Total weight of solids calculated from suspended matters in sewage and effluent=(23·7−2·0)×15·88= 345 grms. Mineral—149 grms. Organic and volatile —196 grms.)

Weight of solids calculated from increase in sludge =2,147 − 1,291 = 856 grms. (Mineral — 372 grms. Organic and volatile—484 grms.)

ANALYSIS OF SLUDGE.

—	At commencement of experiment.	At end of experiment.
	Per cent.	Per cent.
Mineral matter	44·6	44·1
Organic matter	55·4	55·9
Total nitrogen	3·80	3·51
Greasy matter (CCl_4 extract)	4·30	3·80

	Grms.
Total organic nitrogen in sewage	26·8
" " " effluent	3·9
Difference	22·9
Organic nitrogen in final sludge	75·4
" " " initial "	19·0
Difference	2·64

According to the above results the sludge production was equivalent to 24·5 tons of sludge (calculated as containing 90 per cent water) per 1,000,000 gallons of sewage dealt with.

Reference to the figures obtained shows, however, a considerable discrepancy between the amounts of solid matter removed from the sewage and that found in the resultant sludge, even after allowing for the complete removal of colloid matter from the sewage.

In the absence of further evidence the authors do not feel justified in drawing any definite conclusions in regard to sludge production and amount of nitrogen recovered.

USE OF MINERAL PRECIPITATES.

In the course of the laboratory experiments previously referred to, extended trials were made of the effect of the use of mineral precipitates—*e.g.*, hydroxides of iron and aluminium—during the initial accumulation of partially activated sludge. This series of experiments was undertaken with a view to ascertain whether the increased surface action afforded by the bulk of precipitate employed was advantageous in regard to the purification effected and to the rate of activation of the sludge.

So far as Manchester sewage is concerned, the results obtained indicated that no material advantage in regard to either of these questions ensued from the employment of such precipitates in the manner stated; in fact, with the precipitated hydroxides a deflocculating action was frequently obtained, with the production of a distinctly turbid effluent. The addition of a small proportion of thoroughly activated sludge prevented this deflocculation and produced well-clarified effluents.

Similar experiments to the above were carried out with a very dilute domestic sewage, which is received at the Davyhulme works from the parish of Davyhulme. In this series of experiments a precipitate of manganese hydroxide was employed instead of alumina, having in view the possibility of the catalytic action of iron and manganese salts.

For the purpose of studying the effect of mineral precipitates on the production of activated sludge, the "original" method was reverted to, in which the sewage was continuously aërated until the nitrification was completed.

No appreciable difference was observed in the time thus required for the sewage alone, as compared with the samples of sewage to which hydroxide of iron and manganese respectively had been added. It was found, however, that in the case of the control experiment—*i.e.*, sewage alone—a rather longer aëration period was required for the succeeding volume of sewage. The differences exhibited in the rate of production of activated sludge were not such as to render the adoption of such hydroxides desirable. With a dilute domestic sewage of the character of the sewage dealt with, a period of continuous aëration of three weeks only was required for the complete oxidation of the first volume of sewage, and subsequently the times required for the complete nitrification of succeeding volumes of sewage diminished very rapidly, with the consequent production of a considerable bulk of activated sludge within a reasonable period of time.

During the course of the experiments the alternate method of activated sludge production described previously was also employed, which demonstrated that a greater bulk of activated sludge could be produced in a similar period of time as compared with the original method, and in the meantime considerably increased volumes of sewage had been dealt with.

Further experiments in regard to the possibly catalytic action of oxides of manganese added under varying conditions have yielded negative results.

Before leaving this section relating to Davyhulme parish sewage, it may be of interest to give some results which have been obtained in the purification of this sewage.

These results confirm the statement made in previous papers that the period of aëration required for the purification of a sewage by the activated sludge process naturally depends upon the strength and character of the sewage dealt with.

Throughout extended trials with this class of sewage no difficulty arose in regard to the maintenance of the complete activity of the sludge, both as regards clarification and nitrification.

lated, and for these experiments three aërating vessels were used, filled with equal volumes of a mixture of sewage and activated sludge. The volume of sludge in each vessel was strictly one-fourth of the volume of sewage dealt with. Through the three aërating chambers, on the average 13, 27 and 6 cub. ft. of air per hour per square foot, &c., were passed respectively for a period of four hours, when samples were taken and the oxidation effected in each was determined by analysis.

To arrange for the respective mixtures of sludge and sewage to receive the required amounts of air, the aërating vessels before each experiment were filled with tap water and the mercury regulation columns roughly adjusted to allow the required amounts of air to pass through the porous tiles.

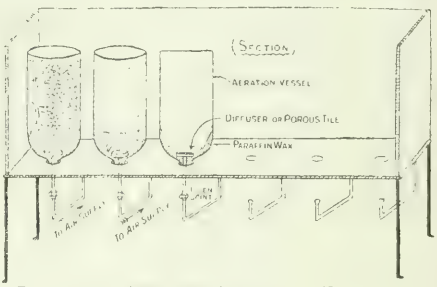

Diagram 1.—Aeration Apparatus (Front and Top Removed).

A finer adjustment was then made, according to the measurements, of the amounts of free air issuing from each vessel.

Having fixed the mercury levels so that the required amount of air for each vessel was obtained, the tap water was replaced by the mixture of sludge and sewage. Throughout the experiments particular care was taken that the amount of air passing through the liquids per minute should be fairly constant for each vessel, and careful measurements of

Table IV.—Davyhulme Parish Sewage.

Results in parts per 100,000.

Average results obtained when working with aeration periods of :—

Temperature 18° C. Proportion of sludge to sewage approx. 1 : 4.	3 hours. 4 fillings per day.		2 hours. 5 fillings per day.		1 hour. 5 fillings per day.		
	Raw sewage	Effluent plain pipe aeration.	Raw sewage	Effluent plain pipe aeration.	Raw sewage.	Effluent plain pipe aeration.	Diffused air.
Four hours' oxygen absorption ...	2·01	0·50	3·88	0·54	1·81	0·57	0·54
Free and saline ammonia	1·65	0·03	2·37	0·43	2·36	1·90	1·54
Albuminoid ammonia	0·42	0·06	0·64	0·07	0·285	0·09	0·07
Nitrite } in terms of NH_3		0·015		0·07		0·02	0·05
Nitrate }		1·55		1·09		0·46	0·75
Dissolved oxygen absorbed 5 days at 18° C.		—		0·96		1·85	1·20

(2) Volume of Air required for the efficient working of the process.

In the previous experimental work the volume of air employed for aëration purposes was always at least sufficient to obtain complete admixture of the activated sludge and sewage. As stated in the earlier papers, this volume varied from 12 to 15 cub. ft. of free air per square foot of tank area per hour.

The cost of the purification process will be, of course, largely controlled by the volume of air required, and therefore it became important to determine, if possible, the minimum air supply necessary for the maintenance of the purification process.

In the following paragraphs are described laboratory experiments undertaken to obtain data in regard to this question of air supply. For the purposes of these experiments it was necessary to design an apparatus in which the volume of air could be regulated and controlled so as to admit certain definite volumes of air to various aëration vessels.

The construction of the apparatus employed will be seen from the following diagrams.

The aëration vessels were contained in an enclosed chamber, the temperature of which could be regu-

the amounts of free air were made at least twice during each experiment.

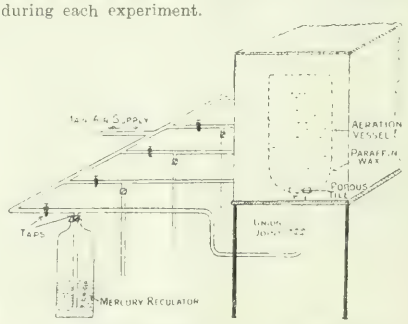

Diagram 2.- Showing Arrangement for Regulating Air Supply.

The following table contains the average results

of a series of experiments using—(1) the usual, (2) excessive, (3) reduced amounts of air

TABLE V.—MANCHESTER SEWAGE.

Results in parts per 100,000.

—	Raw sewage.	Effluents obtained after 4 hours' aëration. Usual air-supply.	Excessive air-supply.	Reduced air-supply.
Four hours' oxygen absorption	2·2	1·54	1·63	1·40
Free and saline ammonia ..	3·32	1·63	1·63	1·61
Albuminoid ammonia	0·84	0·12	0·13	0·12
Nitrate and nitrate as NH	—	1·56	1·44	1·62
Average amount of air used in cubic ft. per sq. ft. tank area per hour	—	15	27	6

The oxidation of the free ammonia in particular has been taken as the guide to studying the effects of varying amounts of air, and in the preceding table a remarkable similarity of results is shown, so that it does not appear to be beneficial, under the conditions of experiment, to increase the air supply above 6 cub. ft. per hour, &c. Further, excessive amounts of air appear to have a slight detrimental effect on the clarity of the effluent.

Having found that under the conditions of experiment 6 cub. ft. of air per hour, &c., ensured efficient working of the process, it became of interest to ascertain whether the air could be even further reduced.

Further experiments were therefore made, using 6, 4 and 2 cub. ft. of air per hour, &c., and the following are the average results obtained:—

TABLE VI.—MANCHESTER SEWAGE.

Results in parts per 100,000.

—	Raw Sewage	Effluents obtained with 4 hours' aeration using:— 6	4	2
		cubic ft. of air per hour per sq. ft. tank area.		
Four hours' oxygen absorption	1·67	1·41	1·40	1·47
Free and saline ammonia	3·46	1·67	1·83	2·33
Albuminoid ammonia	1·08	0·12	0·13	0·17
Nitrate and nitrate as NH	—	1·60	1·41	0·73

Astonishing purification was obtained with the further reduction in the air supply, and the results given above show that even 2 cub. ft. of air per hour, &c., was sufficient to produce a vigorous carbonaceous fermentation. It will be seen, however, that the reduction of air supply from 6 to 4 cub. ft. per hour, &c., had a slight inimical effect on the amount of nitrification obtained, and with the further reduction to 2 cub. ft. per hour, &c., a very perceptible diminution in the amount of nitrate produced was observed. Two cubic feet of air per hour, &c., was insufficient to maintain complete admixture and circulation of the sludge and sewage, and consequently a certain proportion of the active sludge was removed from the sphere of action. Under working conditions the banks of sludge thus formed would eventually become deoxygenated and would be liable to give rise to secondary changes inimical to clarification and nitrification. It may be taken therefore that the results given for "2 cub. ft. of air per hour, &c.," could not be maintained under ordinary working conditions.

From the foregoing results it appears that the minimum amount of air required, under the conditions of experiment, to obtain the maximum oxidation of sewage is approximately 6 cub. ft. per hour per square foot of tank area, only slightly inferior effluents being produced when using 4 cub. ft. of air per hour.

From a consideration of the whole of the results obtained when using varying amounts of air, it has been concluded that the minimum air supply necessary to maintain the maximum rate of oxidation of the sewage does not exceed the amount of air which is required to obtain an adequate mixture of the sludge and sewage.

The amount of air required to produce adequate mixture of activated sludge and sewage on the practical scale, of course, will depend upon the design and depth of tank used. Observations made during large-scale experiments indicate that the original estimate of 12 to 15 cub. ft. of air per hour per square foot of tank area certainly need not be exceeded.

PROPORTION OF ACTIVATED SLUDGE TO SEWAGE.

In the experimental work previously published the proportion of sludge to sewage in general varied from 1: 4 to 1: 3 (measured after two hours' settlement). The former proportion was usually employed, as satisfactory results were obtained within a reasonable aëration period without requiring an excessive tank capacity.

The results of certain experiments, however, led to a reconsideration of the question of the most advantageous proportion of activated sludge to employ, particularly with reference to the purification of a sewage liable to contain appreciable quantities of inhibitory trade effluents.

For the purpose of obtaining information with regard to this question, the apparatus described in the previous section was employed. Preliminary trials with excessive volumes of activated sludge indicated that, from the point of view of practicability, when working on the fill and draw system, the proportion of 1 volume of sludge to 1 volume of sewage should not be exceeded, mainly on account of the difficulty of settlement of the sludge.

The detailed investigation was therefore confined to a study of the effect of varying the proportions of the activated sludge present from 1: 4 to 1: 1. In each experiment the same sample of sewage was aërated in the aëration vessels with a definite proportion of sludge, with an air supply sufficient to allow complete circulation of the sludge and sewage.

In Table VII. are given the average results of the aëration, for stated periods of time, of Manchester sewage mixed with varying proportions of activated sludge.

It will be seen that with the proportion of sludge to sewage of 1 to 4 a maximum aëration period of four hours was allowed. As the proportion of sludge was increased the maximum aëration period allowed was reduced in proportion to the reduction in volume of sewage dealt with, and thus the results obtained with the maximum aëration period represent in each case a similar air expenditure. In the experiments where increased volumes of sludge were employed samples were taken at intervals during the total aëration period.

A general consideration of these results shows that better effluents can be obtained, without an increased expenditure of total volume of air, by using higher proportions of sludge than those which had been employed previously. The activated sludge used throughout was free from ammonia and in a high state of activity.

It is very difficult to say with any certainty what will be found the most advantageous proportion of activated sludge to employ on the working scale, as so many factors are involved—*e.g.*, character of sewage, maintenance of the activity of sludge, air supply, tank capacity, degree of purification required, &c. From a consideration of the available data it has been concluded, however, that in the case of Manchester sewage considerable advantage would result from increasing the proportion of activated sludge from 1: 4 to at least 2: 3. Reference to Table VII. will show that, when working with this last proportion of sludge, a two-hour aëration period yields a superior effluent to that obtained with a four-hour aëration period when a sludge proportion of 1: 4 is employed.

PROVISIONAL ESTIMATE OF COST OF AËRATION.

The experiments described previously render it possible to estimate approximately the volume of air required for the purification of a given volume of sewage.

In consultation with Mr. S. L. Pearce, city electrical engineer, Manchester, and Dr. Gilbert J. Fowler, consulting chemist, rivers department, Manchester Corporation, a provisional estimate of the cost of aëration has been made on the basis of these determinations, which have been translated by an expert in pneumatic engineering into terms of power required. The latter figures have been confirmed by information obtained through the courtesy of Mr. A. E. Collins, city engineer, of Norwich.

For the purpose of the provisional estimate given in Table VIII., the depth of the aëration

tank has been assumed to be 6 ft., and the cost of electricity 0·5d. per unit (k.w.h.).

Under working conditions it would scarcely be practicable to receive the purified effluent as far as the sludge level, and therefore a margin of 5 per cent and 10 per cent by volume has been allowed in the two respective estimates, using 20 and 40 per cent activated sludge (see cols. 1 and 2).

The tank capacity of the two estimates works out similar, and has been arrived at by calculations according to the following cycle:—

	20 per cent sludge.	40 per cent sludge.
Filling	1 hour	40 minutes
Aeration	4 hours } 8 hours	2 hours } 5 hours 20
Settlement	2 hours	2 hours } minutes
Discharge	1 hour	40 minutes
Number of fillings per day	3	4½
Volume of sewage dealt with per sq. ft. of tank area per day	84 gallons	84 gallons

In estimating the cost, allowance has been made for friction in air pipes and diffusers. The actual cost of the aëration process naturally depends on the aëration period required, which, as previously stated, will vary with the strength and character of the sewage dealt with. The periods given in the

Table VII.—Manchester Sewage. Varying Proportions of Sludge and Sewage.

Results in parts per 100,000.

	Raw sewage.	20 vols. of sludge to 80 vols. of sewage.	30 vols. of sludge to 70 vols. of sewage.		40 vols. of sludge to 60 vols. of sewage.			50 vols. of sludge to 50 vols. of sewage.		
		Effluents obtained after aerating for —								
		4 hrs.	2½ hrs.	3 hrs.	3½ hrs.	2 hrs.	2½ hrs.	3 hrs.	1½ hrs.	2 hrs.	2 hrs.
Four hours' oxygen absorption	1·241	1·76	1·47	1·43	1·50	1·39	1·29	1·21	1·29	1·50	1·19
Free and saline ammonia	3·71	1·83	1·49	1·23	0·96	1·14	0·84	0·54	0·83	0·57	0·39
Albuminoid ammonia ...	1·16	0·19	0·13	0·115	0·115	0·11	0·10	0·115	0·115	0·12	0·10
Nitrite } in terms of NH		0·14	0·13	0·13	0·14	0·13	0·14	0·14	0·11	0·14	0·14
Nitrate } ...		1·29	1·40	1·71	1·94	1·59	1·99	2·21	1·67	1·91	2·16
Percentage purification of raw sewage calculated on											
(1) 4 hours' oxygen absorption ...		86	88	88	88	89	90	90	90	90	91
(2) Albuminoid ammonia		84	89	90	90	91	91	90	90	90	91
Percentage loss of ammonia		51	60	67	74	72	77	85	77	85	89
,, ammonia oxidised (NO_2, NO_3)		41	41	50	56	46	57	63	52	57	62

above table are sufficient to produce, under suitable conditions, satisfactory effluents from average strength Manchester sewage.

From the foregoing results it may reasonably be concluded that some advance has been made with regard to the economics of the process.

It has been demonstrated:—

(1) That, apart from the use of slurry from percolating filters, the initial production of activated sludge can be facilitated and obtained with considerably less cost than originally was the case.

(2) That under certain controlled conditions the volume of air required may be considerably less than previously estimated.

(3) That there is an economic advantage in employing an increased volume of activated sludge with special reference to the rate of nitrification.

In conclusion, it may be said that the estimated costs of aëration given in Table VIII. indicate that the activated sludge method of sewage purification is eminently a practical process.

The authors are again indebted to Dr. Gilbert Fowler for his continued interest in the research, to the Worshipful Company of Grocers for extended facilities, and to the Rivers Committee of the Manchester Corporation for permission to publish the results of the work which has been carried out at the corporation sewage works, Davyhulme.

Table VIII.—Provisional Estimate of Cost of Aeration.

Vol. of sludge (measured after 2 hours' settlement).	Vol. of effluent removed at the end of each period.	Aeration period.	Tank capacity.		Vol. of free air per million gallons.		Cost per million gallons of sewage.	
			Per million gallons.	Per daily flow.	Min. 6 cub. ft. per sq. ft. per hour.	Max. 15 cub. ft. per sq. ft. per hour	Min. air supply.	Max. air supply.
					cub. ft.	cub. ft	s. d.	s. d.
20 per cent	75 per cent	4 hours	Area 11,800 sq. ft.		880,000	2,150,000	11 0	27 6
40 per cent	50 per cent	2 hours	Depth 6 ft. Capacity 442,500 galls.	10·6 hours	640,000	1,600,000	8 3	20 6

Manchester Car-shed Accommodation.—The formal opening took place on Tuesday of the Hyde-road, Manchester, car-shed extension and new stores. Additional shed accommodation has been provided for ninety cars and a three-storey building for the storage of large quantities of materials and equipment. The total area of the sheds and buildings covered by roofs is now 10½ acres. The amount of the contract for the extension and new stores was £46,059. The architect was Mr. Gibbons, who has also designed the other car sheds. The total cost of land and buildings at Hyde-road up to now is £277,000.

Rights of Riparian Owners.—Some discussion took place recently at Gainsborough Rural District Council regarding the rights of the riparian owner. The council have control of many miles of the highways bordering the Trent, and the land, known as the foreshore, between the roads and the river, is claimed by the owners of the adjoining land. It was stated that at Owston Ferry the owner declined to take steps to prevent the washing away of the banks and the foreshore by the tides, the result being the undermining of the roads, which were in a dangerous condition. This had been pointed out to Sir H. B. Bacon, as a member of the Humber Conservancy Board, and he replied that the Conservancy Board had no control over the channel of the river. The chairman, Mr. Geo. Roadley, said owners had so far been only too willing to protect their property from river encroachments. A resolution was proposed that the council should repair the foreshore, but Mr. Gravenor Roadley said if such a precedent were set the council might be involved in an expenditure of many thousands of pounds. The clerk said the law in regard to the matter was simple. There was no power to compel a riparian owner to protect his property. If he chose to let his land be washed away by the tides he could do so. The council decided that a committee, assisted by the clerk, should draw up a report.

Institution of Municipal and County Engineers.

NORTH-EASTERN DISTRICT MEETING AT BRIGHOUSE.

The North-Eastern District of the Institution of Municipal and County Engineers held a well attended meeting in the Public Offices at Brighouse on Saturday, Mr. J. P. Wakeford (Wakefield), chairman of the district presided, and there were present Messrs. W. T. Lancashire (Leeds), F. Massie (Wakefield), W. J. Steele (Newcastle-on-Tyne), T. H. Hailstone (Bristol), Leslie Roseveare (South Shields), A. Rothera (Spenborough), L. Ivens (Wakefield), A. E. Loach (Wakefield), F. W. Spurr (York), H. P. Foster (Leeds), W. Fowlds (Keighley), C. Vawser (Ripon), W. F. Batney (Huddersfield), S. S. Haywood (Brighouse), E. J. P. Bedford (Spenborough), T. H. Rawnsley (Ossett), E. J. Silcock (Westminster), G. W. Thompson (Hipperholme), H. M. Driver (Tadcaster), G. A. Hart (Leeds), M. Sabry (Leeds), W. Dixon (Leeds), H. Taylor (Barnsley), and C. F. Wike (Sheffield).

The Mayor (Alderman E. Thornton) offered the members of the institution a hearty welcome to Brighouse. They occupied a most important position in the various boroughs, as they had very largely under their control the spending power of the corporations which they represented. In those circumstances he felt it was very advisable for municipal engineers to meet in conferences of that character from time to time, so that they might discuss new ideas which were being launched from time to time for their own welfare and the welfare of the corporations which they served. Referring to the war, he said that they in Brighouse recognised that they had to do what they could, not only for the welfare of the town, but for the good and well-being of their country. Each one of them ought to do his duty in these trying times. He paid a tribute to the excellent work of Mr. Haywood as their borough engineer.

The Deputy Mayor (Alderman D. C. Holmes) also offered the members a sincere welcome to the town. They were, he observed, intimately connected with the progress and well-being of the town which they served.

The Chairman, on behalf of the members of the North-Eastern District, thanked the mayor and deputy mayor for the kind welcome they had given to the members of the institution. They felt that their visit to Brighouse would be marked with pleasure to themselves and, they trusted, with advantage to the municipalities they were called upon to serve. The North-Eastern District comprised some 170 members in Yorkshire, Northumberland and Durham, and the attendance that day was a very fair muster, considering the distance some of the members had to travel.

The meeting then proceeded to consider the district business.

The Chairman said his first duty was to apologise for the absence of their honorary secretary. Mr. Kirby had obtained a commission in the Royal Engineers, and he proceeded on Wednesday to Chatham to take up his new duties. Mr. Kirby came over to Wakefield before taking up his military duties and handed to him the books and documents of the district.

The chairman then read the minutes of the district meeting at Doncaster, which were confirmed.

The chairman announced that letters of apology for non-attendance had been received from the president (Mr. H. T. Wakelam, Middlesex), T. P. Frank (Stockton-on-Tees), F. W. Bricknell (Hull), E. Willis (Chiswick), J. H. Drew (Wath-upon-Dearne), and E. Picker (Beverley).

RESIGNATION OF HON. DISTRICT SECRETARY.

The chairman said he had received a letter from Mr. F. O. Kirby, the borough engineer of Doncaster, tendering his resignation of the office of hon. district secretary, as he had accepted a commission in the Royal Engineers, and was leaving Doncaster that week. He had written to the secretary of the institution asking him what course he would suggest the district should take, and he had received a letter from Mr. Dudley Robinson stating that in the case of another hon. district secretary the district had appointed an acting secretary during the absence of the hon. district secretary. He suggested that course might be followed.

Mr. W. E. H. Burton, of Wakefield, was appointed acting secretary during the absence of Mr. Kirby.

Mr. F. Massie (Wakefield) proposed a vote of congratulation to Mr. Kirby on having obtained a commission, with best wishes for his success in the temporary career he had taken up.

Mr. S. S. Haywood seconded the resolution, which was carried unanimously.

ELECTION OF EXECUTIVE COMMITTEE.

The meeting then proceeded to consider the election of an Executive Committee for the district for the year, which resulted in the selection of the following: Messrs. C. F. Wike (Sheffield), W. T. Lancashire (Leeds), H. P. Foster (Leeds), F. Massie (Wakefield), W. J. Steele (Newcastle-on-Tyne), Leslie Roseveare (South Shields), J. P. Wakeford (Wakefield), F. O. Kirby (Doncaster), ex officio, F. W. Bricknell (Hull), F. W. Spurr (York), E. Picker (Beverley), J. F. Smillie (Tynemouth), W. E. H. Burton (Wakefield), T. P. Frank (Stockton-on-Tees), and G. H. Whitaker (Sunderland).

REPORTING OF NORTH-EASTERN DISTRICT MEETINGS.

The meeting then considered a report from the executive recommending that the Press be not invited to attend the North-Eastern District meetings in future, but that the honorary district secretary have an official report prepared for publication in the *Journal*, and that this report be furnished to the technical press if they desire to publish it.

The Chairman read a long letter from Mr. Drew, of Wath-on-Dearne, protesting against the proposal to exclude the Press from future district meetings.

The chairman expressed the opinion that it was not in the mind of the council that the technical press should attend these district meetings.

Mr. C. F. Wike: I think that is so.

Mr. Rothera (Spenborough) moved that the recommendation of the Executive Committee be not adopted.

Mr. L. Roseveare (South Shields) said the question was, What was best from the point of view of members of the institution? If they went to other institutions they would find they had round-table talks, and he was told that the amount of good was more from these round-table talks than from open meetings. They appreciated everything the Press had done in the past, and the executive had framed the resolution with every courtesy to the Press; but he did suggest that the younger members had refrained from speaking as they would not have done if the Press were not present.

Mr. Fowlds (Keighley) said the greater freedom with which they could speak and ask questions if the Press were not present had influenced him.

Mr. W. J. Steele (Newcastle-on-Tyne) believed the student members were diffident of speaking if they were going to be reported.

The recommendation of the executive that all future district meetings of the North-Eastern District shall be private was adopted.

THE LATE MR. J. H. JEVONS.

Mr. E. J. Silcock (Westminster) moved a vote of condolence with the family of the late Mr. J. H. Jevons, borough surveyor of Hertford. He said the late Mr. Jevons had been a member of the institution for many years, and they would all agree in placing on record their appreciation of his high character and their sorrow at his untimely death.

Mr. C. Vawser (Ripon) seconded the resolution, which was passed in silence, the members standing in their places.

THE DUTIES OF A MUNICIPAL ENGINEER IN THE PRESENT WAR.

By S. S. Haywood,
Borough Engineer, Brighouse.

I do not consider any apology is necessary for submitting a few observations on a subject quite apart from the usual routine and practice of our district meetings, and in not giving you the stereotyped description of work done and schemes carried out in my capacity as engineer and surveyor to this corporation.

The times through which we are passing are abnormal, and normal methods must wait until normal times return. When a man is fighting for

his life he has not time to waste telling you how he ties his cravat or where he buys his shoelaces, and while I agree that municipal work must go on and cannot cease in its entirety because we are at war, yet I think we can more usefully employ our short time this afternoon in discussing what are the duties of a municipal engineer and surveyor during the present war.

In any previous war within living memory conditions have been such that our employment and duties have not been seriously interfered with, nor have we felt any particular or personal call, but now when the nation's destinies are at stake, and it is a grim fight of life or death to us as an Empire, it behoves each one of us to ask himself, "What is my duty? Am I doing all I can?" This is no doubt a question that has greatly exercised the minds of a good many of us.

Age, position, responsibility, work in hand, health and home ties have all a great bearing on any decision that one must make, and no hard-and-fast line applicable to all of us can be laid down, but perhaps some broad lines of action might be suggested.

On broad lines, our first duty is to the State. Our birthright is our obligation.

How can each best serve the State? Is it better for him to offer himself unconditionally to the State, or should he content himself with increased effort and endeavours to effect economy in carrying out his duties under his council? And is this really enough? Is there also no other way in which he can be of service?

It will be admitted, I think, that, owing to the curtailment of work by the Local Government Board orders, and the very proper wave of economy that is spreading over our respective councils, our work as a rule it not at present, nor is likely to be until the termination of the war, of quite the strenuous character of the pre-war period; in fact, that our energies are not being taxed by the constant task of bringing out new schemes, or altering or improving old ones, and that our work is likely to be confined to more or less routine channels; and some of us might therefore be more easily spared now for direct service under the State than at any other time.

I am proud, and we must all be proud, to think of the cheerful and ready response that has already been made by the members of our profession as a whole; but the need is urgent, and it is a time for super-effort, and no man should consider he is doing his best unless he is using his energies to the last ounce of his strength.

To my mind, by his training, his varied experiences, the habit of handling men, the organisation and methods he has to employ in his daily work and profession, a municipal engineer and surveyor is peculiarly fitted for service in one or other of the many branches of the military service.

To those head officials who are young, healthy, single, and without incumbrances or home responsibilities a decision should not be difficult, and, provided his council can and will spare him, in my opinion he should answer the call.

To those who are assistants or engaged in less responsible positions, under similar circumstances to those last mentioned, I cannot conceive any hesitation possible.

To those who have had previous military training in some form or other, and who are not dependent on the councils they serve, the call should appeal with some weight.

Should, however, permission be refused by his council or his work suffer unduly by his absence, or unemployment be caused, or should his dependents be placed in straitened circumstances in the event of an untoward accident to him, and likely to become a burden to the State, then, in my opinion, one cannot altogether blame him for not enlisting until such time as (say, in the event of an invasion of our country) every able-bodied man must be prepared to sacrifice himself for his country's preservation. In the meantime he can, and ought, by joining some Volunteer movement, to prepare himself for instant service in any emergency, and not be compelled in such an event to stand on one side, a useless non-combatant, and to this I will refer again later.

Assuming, then, that one's duty is to remain under one's council, how can we still best serve the State?

I consider that it is our duty to encourage all our eligible assistants to enlist, but we should make every endeavour before urging them to ensure their reinstatement on their return, and to see that some allowance is made them by our councils. Our work may suffer, the efficiency of our departments may be impaired. Granted; but it is the least we can do, and it would be a poor and unpatriotic example to outside employers of labour to see our staffs made up of enlistable men. We must see that, as far as we can, we have no shirkers around us, and particularly try to avoid the encouragement of those selfish and callous individuals who refrain from enlisting in order that they may profit by the absence of their more patriotic professional brethren.

This depletion of our staffs may bring up the question of the employment of female labour. In the absence of male assistance, should the engineer recommend this? For typewriting, correspondence, keeping wages and store books, and general bookkeeping, simple tracing and other similar work, girls might, I think, be employed with advantage, as they are in banks and other similar institutions, but on the distinct understanding that the appointments are temporary only. It would not be fraught with the same danger of them working their way into engineering assistants as might be the case in the employment of non-professional men (unfit for military service) being brought in to do the same work. This point, I hope, will be ventilated.

The next point is the question of economy.

I think we should ask ourselves not "What do I want?" but "What can I do without?" We all, I suppose, pride ourselves on our economy, but there are many ways in which we can still economise. In our indoor work, in the necessities of the drawing office, we must be content with cheaper materials, less expensive stationery, printed headings instead of die-stamping, duplicated specifications and quantities instead of printed matter, tenders by invitation (where allowed) instead of by advertisement, as we all have lists of reliable contractors in our neighbourhoods, and in other similar ways. These may seem small matters, but they all help.

We must economise in our indoor work. Essentials only are vital now, and diagrams, statistics, particulars and information entailing much clerical work not absolutely necessary must be left for happier times.

In our outdoor work, if circumstances will permit, we must weed out our less capable and industrious men. Corporations are not charitable institutions, and with the increase of wages, coupled with the decreased allowances made to us, we must be more careful than ever to see that full value is obtained for the money granted to us. Our departments cannot afford to carry a dead weight of inferior servants; but the right class of labour is very difficult to get, and we must therefore do the best we can with the material we have at hand. We see our best labourers enlisting day by day in the Navvies' Battalions and leaving us still more short-handed, and our committees must be made to thoroughly understand the difficulties from which we are suffering, as economical work is most difficult under these circumstances.

In highway work the restrictions placed on expenditure by the Local Government Board have upset many of our plans, and in this town a very bad portion of main road paving for which the granite setts had been obtained and a contract let for the work has had to be held over. This, I think, has been a very great mistake, for our main roads and important thoroughfares should be kept in good condition, and the policy of little and often is a sound one, I think, in the matter of repair, but what we do use should be good, and the economy should be in quantity and not in quality.

On main roads, I know from experience that it is rather difficult to carry this out. The county authorities are as pinched for money as we are; but, owing to the congestion on our railways by their being taken over by the authorities for military purposes, the main roads are being forced to carry on enormously increased traffic, and we must use every effort to induce the county councils to grant us sufficient money to keep them in at least passable condition, and thus lessen the great wear and tear on the mechanical vehicles that are now using the roads.

It should be looked at, I think, from a national, and not a parochial, standpoint. An expenditure of £50 or £100 in road repairs in certain places will often save hundreds of pounds' worth of damage to the stream of commercial vehicles passing over them.

The secondary and less important streets, provided they are not in such a condition as to be dangerous

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or injurious to health, must be left, and the public will have to put up with a certain amount of inconvenience and discomfort.

In quiet and settled weather, without much wind, street washing, watering and sweeping can be cut down, with a saving in water, team labour, and brushes, all of which are expensive items, and except for a little untidiness there will be no great harm done.

Sewer cleaning, flushing, gully emptying, must, of course, be attended to, but as a matter of need, and not as a matter of routine solely.

If not already in operation, money can be realised by the sale of street manure and sweepings, market refuse, old tins and waste paper from the sanitary and destructor department, and, in the case of this corporation, we also sell half-burnt cinders riddled from dry domestic ashbins, but care should be taken to see that it is only used in trades or places where no nuisance can be caused.

In public lighting we have been exceedingly restricted, and thereby effected an unwilling economy (as far as the general public are concerned), but it has shown us, owing to the decrease in crime, with what little light we can manage, and now that the lighting restrictions are removed in many cases, I think we should be very careful in taking advantage of it, as street ligrting is very expensive, and great economy can be exercised with regard to it.

In the question of the renewal of plant and implements even of the less important kinds, our personal inspection is necessary to be satisfied that rigid economy is practised by our foreman and storekeepers. I am referring now to the smaller authorities; in the more important towns the engineer himself could not of course attend to this.

Accumulations of old iron, lead piping, disused plant of all kinds, anything that has a marketable value, should be turned into money.

I may be told that all the matters I have mentioned are the usual practice of most of us, but things are apt to be taken for granted, and at a time like this it is just as well to be reminded of them occasionally, so that we can ourselves see that the practice is being carried out.

Should opportunity occur, schemes held in abeyance owing to the war can be carefully thought and worked out in readiness for the resumption of normal affairs, and arrears of work can be brought up to date; for who among us has not felt the need of a little respite at times to get within even speaking distance of the deluge of orders and instructions so freely showered upon us by our councils?

Many other points under the heading of duty to our councils may probably occur to the members, and these I hope will be brought out in the discussion.

There is also the financial position as it affects each one of us and our families. What is our duty in this direction? The cost of living is increasing by leaps and bounds. Rent and rates are likely to go up; new taxes are to be imposed; charitable calls, nay, demands almost, are made on us daily. We see the working classes and the men we are responsible for asking for and getting increased wages and allowances to meet the advance in prices. Our remuneration remains stationary. Should we grin and bear it, or should we, for the sakes of our wives and families, ask some consideration at the hands of our councils?

I know that it is a popular fallacy that public officials are all too well paid. We, however, with the calls upon us, and the positions we are expected to keep up, know differently; and while I am not myself in favour of it, and should not adopt this course, I know this subject has been mooted in some districts, and therefore I think it is a legitimate phase of the subject to bring before you for your opinion.

How can we further help the State apart from our actual duties to our councils?

The nature of our work and the positions we occupy put us into such close touch with practically everyone in our districts that there are many ways in which we can be usefully employed in such spare time as we may have. We are not accustomed to having much of it, but at a time like this I consider it a disgrace to have any, except such as may occasionally be necessary for health's sake.

We should put ourselves at once in touch with the military authorities and recruiting committees of our district, and give all assistance possible. We should study the capabilities of our district for the training of troops and billeting of soldiers. If companies are being raised or trained in our towns, we can find them suitable areas for drill, manœuvres and trench digging; obtain for them privileges and facilities at the hands of our councils in the use of parks and recreation grounds; the use of public baths free of charge; the use of halls as recreation or rest rooms; loan them watch-boxes for their guard duties, tables, chairs, notice boards, clocks, utensils for their temporary guard-rooms, &c.; in fact, beg or borrow for them anything they require for temporary use that they would otherwise have to purchase.

I have been rather fortunate in being of some service in this direction in Brighouse, and have experienced the great use an engineer and surveyor can be to the military authorities by the expenditure of a little time and trouble.

This brings me to my last suggestion and recommendation, but one that I feel very strongly upon, and one which I wish to urge upon you as earnestly as I can; and that is, if you cannot be spared to enlist and do your bit now, do the next best thing —make yourself fit, and put yourself in a position to be able to do it when required, by joining a Volunteer Training Corps.

I hope you will consider this suggestion seriously. I know from bitter experience that it is customary to treat it with derision; but, above all, don't trot out the old, threadbare statement, "Oh, if I do it at all, I shall do it properly." I'm weary to death of hearing this. The man who says that is trying to obtain cheap applause for a thing he never intends to do.

Don't say you're too busy. We are all busy, and it's the busy man one goes to to get a thing done. If your nights are taken up, you've still your Saturdays and Sundays, and a change of occupation is as good as a holiday.

Don't say you're too old. We have men of over sixty in our various corps who are most regular attenders on parade, and who state that their training has made them feel years younger.

Don't consider yourself too good for it. There are men of as high and possibly higher standing than any of us who are content to be simple privates in their corps.

There is nothing derogatory in training and preparing oneself for duty. The movement is no toy or game. It is a serious, genuine and successful attempt to form a third line of defence for our country. The Government and War Office have been very lukewarm about it, but they have reluctantly been compelled to give us recognition, and every day sees the gradual weakening of their former oppo-

sit on and the improvement of their attitude towards us.

When 500,000 to 1,000,000 men are determined to be made use of and will doggedly persist in their endeavour, it's a stiff job for any Government to kill the movement entirely.

An engineer and surveyor can be of the utmost service in the work of a Volunteer Corps. His organising ability and business training, familiarity with committee work, his engineering knowledge, the close touch he has with the leading business people of the town and neighbouring landowners all enable him to assist and obtain privileges for the corps that another might have difficulty in obtaining. In the instruction he can afford in map reading, in the use of tools and implements in trench digging, the advice he can give as to the country to be used in field operations, the preparation of maps for sham fights, the getting out of diagrams for distance judging and musketry, his assistance can be most useful.

The fact that Volunteer Corps do all they can to assist recruiting; that they take and train boys from sixteen to nineteen, those medically unfit, and men over military age; that they have sent literally thousands of men to join His Majesty's forces, alone justifies their existence, and when, in addition, they are prepared to undertake, and are undertaking in their spare time and at great sacrifice, duties to assist the military and police authorities in various parts of the kingdom, and are gradually being trained and fitted for actual military service, if we are loyal subjects of our King, and have the welfare of our country at heart, we should give the movement our cordial and active support, and the most practical support is by making our sacrifice and at once joining or helping to form a local corps.

(To be concluded.)

CORRESPONDENCE.

Εἰς ἀνὴρ οὐ πάνθ' ὁρᾷ
(One man does not see everything.)
—Euripides.

THE WAR AND THE ROADS.

To the Editor of The Surveyor.

Sir,—The curtailment by the Government of the income of the Road Board has resulted in some misapprehension as to the effect it need have upon the upkeep of the roads in this country. It would be little short of a national disaster, and a foolish misconception of economy, if our roads were to be altogether neglected in consequence. But this is, obviously, not intended. The local authorities will, no doubt, in the exercise of their discretion, continue the maintenance of their roads. Before the Road Board came into existence many of our county councils and other road authorities had maintained their roads in relatively good condition, and the advent of the Road Board enabled a large number of the main roads to be put into such first-class condition as will enable them to remain safe and sound for some years to come, with a modicum of attention.

There should be no cause for alarm at the action of the Government, but, on the contrary, their action should be applauded in the present abnormal circumstances.

Neither should there be any fear of a serious deterioration of our roads if the local authorities will face the fact that judicious and skilful patching, with proper patching material, on the "stitch in time" principle, must take the place of large schemes of improvement. All such schemes must of necessity stand over until after the war, but in the meantime there is sufficient money, if judiciously spent, to keep our roads in such a condition which will prevent serious deterioration.

The future of our roads will, naturally, depend mainly upon the rapidity with which the accumulated funds of the Road Board, now borrowed for war purposes, are allowed to revert after the war to their original purpose.—Yours, &c.,

Wallace E. Riche,
Secretary, Roads Improvement Association.
15 Dartmouth-street, S.W.
October 22, 1915.

Double or Parallel Roads.—A campaign has recently been started in the New England district of the United States in favour of the construction of double or parallel roads each reserved for "one-way" traffic, thus reducing the risk of accident from collisions at sharp turns, glaring head lights, and faulty steering.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not to be hoped that Mr. O. Claude Robson's appeal for more support to the Municipal and County Engineers' Orphan Fund will be successful, and that it will be the means of increasing the funds of this useful organisation? Surely there must be hundreds of surveyors who would not feel a subscription of 5s., or even 10s., a year towards the fund; and would they not "rest more comfortably" if they felt they had done something for the good of others?

* * * *

Was not Mr. Gladwell's paper on "Rural Highways," submitted to the International Engineering Congress at San Francisco, as given in the pages of the issue of The Surveyor of the 15th inst., an excellent, practical and up-to-date *résumé* of rural road making? Was there not much in this paper which could be equally well studied by road makers in this country as well as in America? Are not his remarks on steam rolling alone of valuable practical interest?

* * * *

Can we not all give our hearty congratulations to H. G. Doe, a former Kensington road sweeper, who joined the Naval Division a little more than a year ago, and has now been twice mentioned in despatches and has been given the D.C.M., as well as a medal for conspicuous gallantry? Should we not say to all able-bodied in this country, "Go thou and Doe likewise"?

* * * *

Is there much cause for alarm as to how our roads will fare since the Road Board closed their purse-strings, when we see that in England alone during the three months just ended they gave grants amounting to £71,716 for "improvement of road crusts"? What did highway authorities do before the advent of the Road Board, and are they to back down like the German soldiers are said to do if they have not got big guns at their back?

* * * *

Was the charge of inconsistency which was made by the Health Committee of the Derbyshire County Council against the Local Government Board in connection with the provision of further hospital accommodation for enteric fever and small-pox a "true bill"? Is inconsistency a monopoly of the Local Government Board, and do not other Government Departments often show by their actions that there is still enough of this commodity to go round?

* * * *

Are not some of the ramifications of the effects of the war somewhat remarkable? Was it not curious to read that at Acton the only municipal man who could lop or fell trees had gone to the front, and that the council were in rather a quandary as to what could be done, as estimates from a local woodman for doing the work appeared to be too high? Was it not a happy thought of some one on the council who suggested writing to the Public Gardens Association, who are reputed to execute this description of work without charging any profit on the transaction? Could not this suggestion be followed by other municipalities, and thus save expense?

* * * *

Can we not all somewhat agree with the Swansea Committee who considered that the application for an increase of wages by the men engaged on mixing tar-macadam was a "bit thick" when it transpired that the increase demanded would bring the wages of these men up to 33s. a week? Are not a good many of the claims at present being made for increase of wages a "bit thick"?

Waterproofing of Swimming Baths.—A public swimming bath has recently been erected in Barrow-in-Furness. We understand the borough engineer adopted the powder Pudlo for waterproofing the work.

Protection of Sea Outfall.—"Fairfax" writes: "I should be glad to have the advice of any of your readers on the following matter: Our sewerage outfall pipes, which empty into the sea on an open coast, are supported on wooden piles which are gradually wasting away, and the council are doubtful whether it is better (1) To stack cobbles about the piles, in which case the sand would collect around the piles and form a solid support (cobbles can be had near at hand); (2) to fix groynes, by which means the sand would collect around the piles; or (3) to leave them in their present condition."

Road Construction and Maintenance in Johannesburg.*

By G. S. BURT ANDREWS, M.INST.C.E.

With the foregoing brief explanation of the conditions under which roads have to be made, I shall now proceed to give some particulars as to the method of construction.

Early Types and Treatment.—One of the most difficult problems in Johannesburg is the upkeep of roads which have not been macadamised, *i.e.*, veldt tracks. The nature of the ground varies considerably. There is rock outcrop, consisting principally of sandstone and quartzite, the formation being tilted at an angle of about 50 deg., shale, both hard and soft, and red soil. It is exceedingly difficult to maintain a reasonably smooth and trafficable surface on any of these formations. The rock outcrop wears very unevenly, the shale is rapidly pulverised into mud, and the red soil will not stand heavy traffic or the erosive action of storm water. Drainage furrows cut but a few inches in depth are frequently scoured out to a depth of several feet in a single wet season. The erosion is prevented to some extent by fixing rough wooden piles across the channel at intervals, the distance apart depending on the grade, but in time the channel becomes a series of steps which can hardly be looked upon as satisfactory from a traffic point of view. Except on moderately flat gradients it is better not to cut into the surface of red soil, and to fill in holes and furrows with the best material available when occasion demands. Many attempts have been made to improve washed-out and furrowed roads by forming the carriageway to a proper camber and cutting side drains for the storm water. The result is inches of fine red dust during the dry or winter months, which last from April to September, and considerable mud and scouring out during the wet season. Complaints as to the condition of unmade roads are very frequent, but it has been found from experience that the complaints increase after a road on red soil or soft shale has been formed and graded.

Width of Carriageways.—Prior to 1903 very few of the footpaths exceeded 10 ft. in width. This, in streets 70 ft. wide and upwards, left an unnecessary width of carriageway to construct and maintain, and it was decided, on the recommendation of my predecessor, to reduce the width of the carriageways as much as possible. The ruling width for the macadam is now 27 ft., except for busy thoroughfares and streets in which tramways are laid. For an increase in width over 27 ft. the multiple used is 9, so that the next width would be 36 ft., then 45 ft., and so on. Apart from the great saving effected in cost, it is considered that the streets have a much better appearance with the wider footpaths, and better facilities are afforded for tree planting and the laying of mains.

Cross-section of Roads.—The cross-section of a road should, in the writer's opinion, be as flat as possible, and not more than is necessary to keep the road properly drained, after making a reasonable allowance for wear. An excessive camber is objectionable in many ways—it produces greater friction, increases the wear and tear of vehicles, gives discomfort to persons driving, causes undue wear on the crown of the road, encourages drivers to disregard the rule of the road, and tends to increase the formation of small furrows or corrugations from street watering. The maximum camber for macadamised roads in Johannesburg is 1 in 18. Wherever possible the gutters are kept at the same level on both sides of the carriageway, but occasionally where the crossfall is exceptionally heavy this rule is departed from, so as to give easier access to abutting properties. The section of street gutters and the height of the kerb vary considerably, and depend on the quantity of water they have to carry. In the urban area, where underground drains have been laid, the height of the kerb is usually 6 in. above the gutter. The transverse gradient of footpaths is 1 in 24.

Foundation and Surface.—A large number of the streets in the central and some of the arterial roads have foundations consisting of rough minestone, varying in size from 9 in. by 6 in. by 4½ in. to 4½ in. cube. This was hand-packed, and the thickness when consolidated was not to be less than 7 in. Before rolling, the interstices of the foundation stones were filled with small stone, gravel, or other selected material. Careful observations have been made of the condition of roads made with and without the large stone foundation, and it is evident in the majority of cases that the roads with a foundation give no better result than those without. As a rule the natural foundation in Johannesburg is good, and in many cases it would be sheer waste of money to excavate a good hard bottom in order to put in a rough stone foundation. When the writer was employed in one of the London municipalities it was customary to put in a foundation of what was locally termed hard core, 12 in. thick, on a clay formation. "Hard core" consisted of brick rubbish well consolidated by rolling, and although the result was good, the writer is of opinion that the natural foundation in Johannesburg is much better than the hard core referred to. After the road has been properly graded and formed to the required camber, the formation or foundation is well rolled. On this a layer of 2½-in. stone is spread so that when consolidated the thickness is 6 in. at the crown and 5 in. at the sides. Before rolling is commenced a small quantity of binding material is scattered over the metal, which prevents creeping and makes the rolling easier. After the metal has been rolled a few times, more binding material is spread on the surface, and this is worked into the voids of the stone by water and sweeping. When the metal is properly consolidated the surface is covered with a thin layer of ¾-in. screenings, and after a few days the road is opened to traffic. For new work the binding material consists of ironstone gravel or undekup, for remetalling work the screening from the old metal are used, as the supply of really good gravel is becoming scarce and difficult to obtain at a reasonable cost.

Rolling.—The rolling is done by steam road rollers, weighing from 8 to 17½ tons. These rollers cost from £650 to £850, delivered in Johannesburg complete and in good order. The average cost per month is as follows: Interest on capital outlay at 6 per cent, £3 5s.; depreciation, 10 per cent per annum, £5 8s. 4d.; maintenance, £11 16s. 4d.; wages: driver, £23 15s.; native, £2 10s.; total, £26 5s.; fuel, £4 15s.; oil, waste, &c., £1 15s.; water, £3 18s. 8d.; total, £57 3s. 4d.

On straightforward work a 10-ton roller will consolidate in a day of 8½ working hours 260 sq. yds. of 2½-in. metal, 6 in. thick on completion.

Watering.—The watering is done by means of 350-gallon vans with ordinary pipe sprinklers, drawn by two horses. These cost approximately £70 delivered. The quantity of water used for road construction averages about 5 gallons per square yard, and the price paid per 1,000 gallons is 4s. 6d.

(To be continued.)

* Second instalment of a paper read at a meeting of the South African Society of Civil Engineers.

Local Government Board and Contracts.—At the last meeting of Portishead Urban District Council the clerk reported that he had been in communication with the Local Government Board on the subject of a contractor's application for an increase of prices tendered at in November last, on account of extra expenses consequent on the war. The reply received was that the local authority must decide in such cases. They would have to satisfy the auditor that any advance made was reasonable.

Treatment of Trade Wastes.—On the minutes of the Trades Waste Committee being submitted at a recent meeting of Worsley Urban District Council, Mr. Rogerson asked why they treated the effluent from bleach works differently to that from dye works? He understood that it cost the community quite as much to deal with the waste from bleaching processes as from dyeing processes. The clerk said that the committee considered the effluent from bleaching nothing like so deleterious as that from dyeing. Mr. Glass said the effluents from dyeing vats and bleaching vats were put under two totally different categories by the Mersey and Irwell Joint Committee, and it was asserted in some quarters that the latter was a distinct advantage to the sewage, as it had a disinfecting effect on the fever matter. He could not say whether the contention was correct, but it was generally accepted. The clerk: The arrangements which we made upon this matter followed on the advice of Dr. Fowler.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, assoc.m.inst.c.e.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

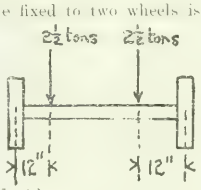
This week answers are invited to the following questions:—

506. Concrete Sewer Construction.—Is it necessary to support concrete sewer tubes with concrete at the sides, the tubes being 21-in. diameter? If it depends on the depth below the street whether they should be supported by concrete or not, then what are the least and greatest depths at which they can be laid without concrete support at the sides? ("Polox.")

507. Design of Retaining Walls.—What are some good, practical rules for the design of (1) brick and (2) concrete (not reinforced) retaining walls to withstand earth pressure? ("Polox.")

508. Street Construction.—Some new streets are to be laid out involving considerable cutting and filling of the ground. Longitudinal sections of the ground showing the levels of the new road have been prepared. The cutting and filling have to be measured up as the work proceeds. What is the best method of doing this? (Polox.)

510. Axle Stress.—An axle fixed to two wheels is driven at the centre by a chain, and supports two bearings, distant 12 in. from the centre of the wheels, the load on each bearing being $2\frac{1}{2}$ tons. If the power exerted is 20 h.p., and the rate of turning is 30 revs. per minute, find the maximum intensity of stress in the axle if its diameter is 5 in. (Student.)



[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

509. Sewerage.—A 12-in. sewer, laid at a gradient of 1 in 50, has an average depth, dry-weather flow, of 1 in. How would you calculate the depth of six times the dry-weather flow? A leaping weir is fixed 12 in. below the outlet of the pipe. At what distance should the edge of the weir be fixed from the outlet of the pipe to take all above six times dry-weather flow? Give mathematical and graphical calculations. ("Pennbourne.")

The formula for the velocity of discharge of sewers, pipes, &c., is $V = C\sqrt{RS}$.

Where V = velocity in feet per second.
C = coefficient of discharge.
R = hydraulic mean depth in feet.
S = sine of slope.

With the same pipe and slope, C and S will be the same, and therefore the velocity of discharge will vary as $\sqrt{R}$.

The discharge of pipes is given by Q = VA.

Where Q = discharge in cubic feet per second.
V = velocity of discharge in feet per second as found above.
A = area of pipe in square feet.

Now as V varies as $\sqrt{R}$, Q will vary as $A\sqrt{R}$.

It will therefore be necessary to determine the value of $A\sqrt{R}$ for 1 inch depth of flow; take six times this value and then by trial and error find the depth of flow that will give it. This is most conveniently done by the aid of tables, giving the value of $\sqrt{R}$ and A for a pipe in terms of its diameter, such as that given in Moore & Silcock's "Sanitary Engineering," Vol. I.

1 in. depth of flow [illegible] of diameter = ·0833d.

The nearest value given in the tables to this is ·082·09, but as the values are roughly proportional, the odd decimals may be taken pro rata, as follows:—

d	A	$\sqrt{R}$
·09	= ·035012	·23969
·08	= ·029435	·22654
(·09 − ·08)	= ·005577	·01315
$\frac{1}{8}$	= ·001526	·00438
·08	= ·029435	·22654
·833	= ·030961	·23092

$\therefore A\sqrt{R} = ·030961 \times ·23093 = ·007195$

Then for six times the flow of 1 in. depth we have

$A\sqrt{R} = 6 \times ·007195 = ·043170$

for a depth of ·21d, A = ·119898 and $\sqrt{R}$ = ·35487

$\therefore A\sqrt{R}$ = ·042248 for a depth of ·22 d A = ·128112 and $\sqrt{R}$ ·36222

$\therefore A\sqrt{R}$ = ·046305.

It will therefore be seen that the value of d lies between ·21 and ·22 of the depth, or more nearly ·212 d.

·212d of a 12 in. pipe = 2·544 in.

When water flows over the edge of a weir, its velocity causes it to follow a parabolic path, the distance the water is projected depends upon the depth of water on the weir and the consequent amount of velocity. If h is the discharging head, then it is sufficiently accurate for practical purposes to assume that the mean velocity of the water passing over the weir is $\frac{2}{3}\sqrt{2gh}$. Let x = width of the leaping weir in inches and y the difference in level of the two edges, also in inches, which in this case is 12 inches. Now if a particle of water passes from one edge of the weir to the other (a–f in fig.) in t seconds, then

$$y = \tfrac{1}{2}gt^2 \quad . \quad . \quad .

surface is required, as in this case, y must be the difference in level between the surface of the water and the lower edge of the weir.

In this case, the velocity of discharge, using Kutter's formula $n = 013$, will be 3·59 ft. per sec.

... and due to velocity of approach $= \frac{(3.59)^2}{2g} = .215$ in.

∴ Total Head $= 2.544 + .215 = 2.759$

say 2·76 in.

The value of y will be $12 + 2.544$ in. $= 14.544$

We have found that $x = \sqrt{xy}$

Inserting the values we get

$x = \sqrt{2.76 \times 14.544} = 8.417$ in.

In the above calculation no correction is made for the change of section of a stream flowing from a segmental section, which would be difficult to allow for, but is not probably of much consequence in practice. The problem can be solved graphically by plotting the direction of flow after it leaves the pipe to scale, as shown in figure, making $a = \frac{d}{2}$ and $b = \frac{d}{2} = \sqrt{2}$. Complete the rectangle $abcd$ and divide ab and ad into an equal number of parts. The parabolic path can then be plotted by drawing a fair curve through the intersections of vertical and radial lines as shown. Make the overfall edge of weir between pipe and edge of water $= x$ from a with the value of x required. From the wording of the question it would appear that the weir is required for separating storm-water that has to be treated at the disposal works from that which has not. It must be pointed out, however, that this form of weir does not comply with the Local Government Board's requirements, for with a high velocity of discharge, as when the pipe is running full, the whole of the flow would be diverted into the overflow, instead of six times the dry-weather flow passing on to the works for treatment.

(J. A. R., Cheltenham.)

STREET SCAVENGING AND WATERING IN HOLBORN.

In his report for the year ended March 31st last, Mr. E. F. Spurrell, the borough surveyor, states that the total number of van loads removed from the highways of Holborn during that period was 7,106, equal to 21,318 cub. yds., or 14,212 tons.

The night washing of the main roads in the borough by jet and hose and water vans was extended during the year. It has been found to be a most efficacious method of keeping the highways in a cleanly and sanitary state, and is highly recommended by Mr. Spurrell.

The total quantity of water used for flushing the road surfaces of the borough amounted to 15,882,832 gallons. The watering of the roads was carried out with the council's own vans, the contractor supplying the necessary horses, drivers, &c. The total quantity of water used for all purposes in the washing and watering of the roads amounted to 32,432,832 gallons, and the total cost of street cleansing and watering was £15,929.

Luminous Paint for Kerbstones. A borough engineer asks for the name of a firm which manufactures luminous paint for painting kerbstones, lamp columns, &c., in the absence of street lights.

Municipal Enterprises and Income-tax.—In the House of Commons last week the Chancellor of the Exchequer stated in reply to a question that enterprises owned and carried on by municipal authorities of the nature of a trade or business would be liable to pay the proposed duty on excess profits.

Liverpool Electricity Department. In a statement last week dealing with the progress of the Liverpool electricity undertaking, Mr. Russell-Taylor, presiding at a meeting of the Tramways, Electric Power and Lighting Committee, said the capital expenditure up to the end of 1914 amounted to close upon £2,250,000, and the revenue for the year 1914 amounted to over £300,000, while the increased revenue for the six months ending June over the corresponding period last year was about £8,000. The profits of the whole business undertaking, from the time of its purchase, had permitted the sums of £862,128 to be set aside towards the repayment of capital. Furthermore, the sum of £390,000 had been carried to reserve, depreciation, and other contingencies, and £285,000 allotted to the relief of rates, the contribution on this head for the current year being £25,000.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Glasgow T.C. (October 26th. Lord Hunter and Prof. Scott).—This was an inquiry into the increases of rental of small dwellings in industrial districts in Scotland.—Mr. Walker Smith, of the Scottish Local Government Board, said the standard of working-class houses in Scotland was 40 per cent below that in England, while the latter paid only 13 per cent more. Private enterprise in Scotland had been stagnant for years. There had been a tremendous influx of workmen in the Clyde Valley since the war, and the housing problem was extraordinarily acute. There had been great industrial expansion all along the valley, and 16,000 workmen had to travel from Clydebank and 5,000 from Renfrew to and from Glasgow daily in order to be housed. In Greenock empty houses were practically non-existent, but about 800 of the houses occupied were unfit for human habitation. The same remark applied to many occupied houses in Glasgow. In the Clyde Valley one firm last year employed 11,000 men. This year they employed 16,000, and in the near future expected to employ 23,000. These additional men would have to be distributed over Glasgow. A house monopoly would be established in the Clyde district, and tenants would require some measure of protection against exploitation. The inquiry was adjourned.

APPLICATIONS FOR LOANS.

Arbroath T.C. £2,000 in respect of the smallpox hospital.

Aylesbury U.D.C.—£1,600 for electricity mains.

Merthyr T.C.—£8,250 for the purchase of a school site.

LOANS SANCTIONED.

Burry Port U.D.C. £1,000 for the erection of a public slaughter house.

LOANS REFUSED.

Blean R.D.C. £820 for works of sewerage.

Christchurch T.C. £800 for surface water drainage.

FORTHCOMING INQUIRY.

NOVEMBER. £

2.—**Shoeburyness.** For the enlargement of a sewage tank (Mr. R. H. Bicknell) 2,000

Barking Officials and the War.—Barking Urban District Council claims a unique position in regard to its officials who are serving the country. Its clerk, surveyor, medical officer of health, and electrical engineer have all been released for active service, and the administration of the town's affairs is now being carried on by officials who are merely acting until the termination of the war.

Shropshire Town Planning Scheme.—At the last meeting of the Shrewsbury Rural District Council, the chairman, Mr. Thomas Allan, said the council had determined to prepare a town planning scheme for the district of Old Heath, abutting on the borough of Shrewsbury. Under a temporary arrangement with Shrewsbury Corporation they would be able to carry out their sewering and water supply. The scheme was rendered necessary by reason of the erection of a large engineering works in the rural district.

The Road Board Grants.—The County Councils Association, at a meeting held at Caxton House on Wednesday, considered correspondence which had passed between the chairman and the Chancellor of the Exchequer on the subject of retrenchment, and, as no direct suggestions had come from the Government, decided to ask the county councils to submit their own views and proposals upon economy. A resolution of the Highways Committee that power should be given to highway authorities temporarily to close roads for special reasons or against a special class of traffic was approved, and the resolution will be sent to the Departmental Committee on Heavy Traffic. In view of the recommendation of the Government Committee on Retrenchment in the Public Expenditure that the work of the Road Board should be suspended during the war, a deputation was appointed to wait on the Chancellor of the Exchequer and take other steps to secure assistance from the funds in the possession of the Road Board for road improvements and the withdrawal of Clause 41 of Finance Bill No. 3.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Darlington, housing and town planning—Liverpool, Newcastle-on-Tyne, Sheffield; roads and materials—Aberdeen, Glasgow, Winchester; sewerage and sewage disposal—Bodmin; water, gas and electricity—Bolton, Sheffield.—Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Aldershot U.D.C.—An intimation has been received that the Local Government Board have sanctioned a loan for the proposed extensions to the isolation hospital, and that the work may be proceeded with at once.

Brighton T.C.—The Health Committee recommend the provision of additional accommodation for the staff at the sanatorium, at an estimated cost of £170.

Darlington T.C.—A scheme of improvement is to be carried out at the Bank Top cattle mart, at an estimated cost of £2,000.

Inverness-shire C.C.—The Badenoch District Committee have decided to build a stone bridge at Lynwilg, at an estimated cost of £308. The work will be carried out by direct labour.

Malmesbury T.C.—The question of meeting the urgent need for public conveniences has been referred to committee for consideration.

Ripon T.C.—An application by the city council for borrowing powers for the erection of new baths at Ripon Spa having been refused, instructions have been given for the preparation of estimates and plans for baths to be provided out of revenue, at an estimated cost of £250.

Sheerness U.D.C.—Negotiations are proceeding with the local landowner for authority to build a bridge to connect Somersby-grove with Coronation-walk.

Stalybridge T.C.—The scheme for the extension of the public baths has been completed at a cost of £6,400.

Welshpool T.C.—The council have received a letter from the clerk to the county council forwarding the following recommendation of the county medical officer of health: "That all courts and passages in the county should be limewashed at least once a year by the respective owners, and instructions given to the sanitary inspector to see that this was done." The sanitary inspector was requested to have the recommendation carried out.

HOUSING AND TOWN PLANNING.

Liverpool T.C.—The Treasury have offered no objection to the work in connection with the erection of seventy-one additional working-class dwellings being proceeded with.

Newcastle-on-Tyne T.C.—At Wednesday's meeting of the council a report of the Housing Committee relative to the Walker housing scheme was presented. The contract for this scheme was originally let to a firm the partnership of which had since been dissolved. The lowest tender of those since obtained was that of Mr. Samuel Ferguson, Newcastle, amounting to £133,303 15s. 7d., or an increase of £32,892 8s. 11d. on the tender originally accepted, while the total cost of the scheme, inclusive of architect's commissions, was brought up to £151,409. It having been represented to the Local Government Board that some portion of this cost should be borne from Imperial sources, the Local Government Board now offered to bear 20 per cent of the increased cost of the scheme, exclusive of the cost of streets and sewers, on condition that the scheme was immediately proceeded with and that munition workers engaged by Messrs. Armstrong, Whitworth & Co. were given the preference during the period of the war, as tenants and lodgers in the houses to be erected. The committee recommended that this offer be accepted, and that the tender of Mr. Ferguson be accepted. The report and recommendation were agreed to.

Rugby U.D.C.—The Plans and Estimates Committee, in answer to an inquiry from the Board of Trade, state that the provision of 50 or 100 houses was necessary, and that land had been purchased for a housing scheme. The Board of Trade are asked to state how they propose to enable houses to be built by local authorities to let at an economic rent.

Sheffield T.C.—The town council will at their next meeting consider a scheme for building 286 houses at High Wincobank, at an estimated cost of £90,867.

PARKS AND OPEN SPACES.

Ilford U.D.C.—It is proposed to purchase land for the purpose of a park for the Seven Kings district, but, with the consent of the vendor, it has been agreed to allow the matter to remain in abeyance until after the termination of the war.

Manchester T.C.—The Parks Committee recommend the expenditure of a further £100 in forming boulevards and making a road at the Debdale recreation ground.

REFUSE COLLECTION AND DISPOSAL.

Broadstairs U.D.C.—The surveyor, Mr. H. Hurd, having submitted the question of excluding trade refuse from the dust collection, the council resolved that all trade refuse containing straw, cardboard, paper, shavings, or refuse of a bulky nature, be not removed by the council's carts until further order, and that public notice be given accordingly.

Sheerness U.D.C.—The Local Government Board have refused to sanction a loan for a refuse destructor.

ROADS AND MATERIALS.

Aberdeen T.C.—Councillor George and Mr. A. Findlay, superintendent of cleansing, have been appointed to visit Glasgow and inspect motor street sweeping machines, with a view to the purchase of one at an estimated cost of £650.

Aberystwyth T.C.—The scheme of the county council for a proposed improvement to the road leading from Penybont Bridge to Southgate, at an estimated cost of £260, has been approved, but the work will not be put in hand till after the war. The cost is to be borne in equal shares by the county and town authorities.

Bristol T.C.—A report has been submitted to the Sanitary Committee with reference to the liability of the Bristol Tramways and Carriage Company to contribute towards the cost of maintaining Cranbrook-road on account of the damage being done by the company's 'buses being run at a great speed and generally. The city engineer, Mr. L. S. McKenzie, also submitted a report showing the cost of repairing this road during the last three years. In 1912-13 it was £11; in 1913-14, £396; and in 1914-15, £709. A Departmental Committee was now sitting to consider the law and regulations relating to the construction and use of road locomotives and heavy motor cars in Great Britain. It was resolved that the town clerk write the Local Government Board and ask if they will receive evidence on the subject, and, if so, that the chairman and city engineer attend before them. Further, that the attention of the Watch Committee be called to the damage done to the road by the excessive speed and the cost of repairs, and that a copy of the city engineer's report be sent to them.

Bromley R.D.C.—With respect to certain suggested repairs at Orpington, the highway surveyor, Mr. R. Craig, said he was not in a position to recommend that the work should be done at the present time, because of the labour difficulty. He had now only four men over seventy years of age working for him at Orpington, instead of nine. It would be possible to have certain repairs done, which would tide them over until a more favourable time for the work. The council approved of the surveyor's recommendation.

Brownhills U.D.C.—It has been decided to repair the main road at Shelfield with granite.

Cork R.D.C.—The council have adopted the proposal of the county surveyor, Mr. I. J. Murphy, to repair and improve by steam rolling the main road from Cork to Blarney, between Inchecommane Bridge and Mahony's Gullet, for a length of 490 perches, at an estimated cost of £514, half of this to be county and the other half a district charge, the expenditure

to be repaid in five years in accordance with the county council's steam rolling scheme.

Cuckfield R.D.C.—The surveyor, Mr. A. Macarthur, submitted a plan of School-lane, Horsted Keynes, proposed to be made up and added to the list of highways. It was resolved that the council be recommended to take over the road leading from Horsted Keynes Church to the schools after it had been made up to the satisfaction of the surveyor in accordance with the plan prepared by him.

Egham U.D.C.—Instructions have been given for the construction of about 160 yds. of new kerbing at Stroude Hill, Virginia Water.

Glasgow T.C.—It has been decided to obtain a further supply of motor sweepers.

Gloucestershire C.C.—Sir Ashton Lister presented a report as to the work on the highways, and said an endeavour had been made to curtail expenditure in every direction, except in regard to the maintenance of the roads in as good a condition as possible under present circumstances. There had been no expenditure on what might be termed luxuries. Mr. Hutton complained of the dangerous state of many of the roads for horse traffic. Sir A. Lister said the surveyors were doing all they could to remedy the dangers of which complaint had reached them.

Hemel Hempstead T.C.—It has been agreed to pay half the estimated cost, not exceeding £75, for the repair of Gadebridge-lane, under the direction of the Road Board, for military purposes.

Hinckley U.D.C.—Plans have been passed for the construction of a new street off Station-road.

Hurstpierpoint T.C.—The question of whitening kerbs was raised, and it was claimed that Russian tallow and hot whitewash would defy the weather. Some members were afraid that Russian tallow would lead to slippery ways, but the advocate of the mixture asserted that the required quantity of tallow was small.

Ilfracombe U.D.C.—The General Purposes Committee have been authorised to consider the question of improving the makeup of the district roads.

St. Austell R.D.C.—An estimate is to be prepared for an improvement scheme at Tregonissey.

Southend T.C.—It has been resolved to make up the remaining portion of Southview-drive under the Private Street Works Act.

Winchester T.C.—The Road Board have written that they had authority from the War Department to proceed with the works of improvement of roads in the city for military purposes, estimated to cost £7,740, on the understanding that the council would contribute £3,244, the amount included in this year's expenditure on highways, towards the proposed expenditure.

Worthing T.C.—The Highways Committee report that the borough surveyor estimates that a saving of £600 can be effected on the annual estimates by deferring repairs under the heading of highway, maintenance and street cleansing.

Yeovil T.C.—Widening and improvement schemes are to be carried out in Reckleford and Sherborne-road, at an estimated cost of £420.

SEWERAGE AND SEWAGE DISPOSAL.

Barrowford U.D.C.—The 9-in. pipes from the small septic tanks to the carrier on the large septic tanks are to be replaced by 12-in. pipes.

Bodmin R.D.C.—It has been agreed to proceed with a comprehensive scheme for main drainage on the lines already laid down, subject to any modification which might be found desirable.

Earby U.D.C.—Consideration is being given to proposals for the completion of the effluent sewer through Booth Bridge Farm.

Grantham R.D.C.—A letter has been received from the Local Government Board, in reply to the clerk's letter requesting the board's approval of the proposal that Mr. H. C. Rudkin, the inspector of nuisances, should be allowed to undertake private practice as an architect and surveyor. The board adhered to the opinion communicated to the district council in their letter of July 21, 1909, that the services of a whole-time officer were required in the district, and that they were not prepared to sanction the suggested arrangement, with a view to the repayment of a moiety of the inspector of nuisances' salary from the Exchequer contribution to the county fund.

Ossett T.C.—The new Spa sewage disposal works, completed at a cost of £11,839, were formally opened recently. The works were designed and carried out by the borough surveyor, Mr. H. Holmes, with direct labour.

WATER, GAS, AND ELECTRICITY.

Barrow-in-Furness T.C.—The water supply is now augmented by 600,000 gallons daily from Yarlside, where there are springs in the old iron ore pit workings.

Bodmin R.D.C.—It has been agreed to afford Mr. F. C. Lander the necessary facilities for the construction of the proposed water supply, subject to an agreement being entered into between him and the council that in case the council should promote a more comprehensive scheme for the district, they should have the option of purchasing the works at any time after completion at a valuation.

Bolton T.C.—It is stated that the Waterworks Committee have been considering the future water supply requirements of the borough, and a private visit has been paid by the committee to a site in the Lune valley. The general feeling among those who inspected it was that it was admirably suited to the purpose. Nothing definite has been decided in the matter, but it is probable that the committee will consider the whole question in the near future.

Darlington T.C.—The Electricity Committee are seeking the sanction of the Local Government Board for the purchase of an additional 3,000-kw. set for the electricity undertaking.

Grantham R.D.C.—The council have referred to the Health Committee a letter from the Local Government Board inquiring what steps had been taken with regard to the water supply at Barrowby.

Hackney B.C.—The Electricity Committee are recommending the borough council to spend £5,749 on sites for electricity sub-stations and house services.

Pembroke (Co. Dublin) U.D.C.—It has been agreed to provide a new engine for the electric lighting plant, at a cost of £2,000.

Penrith R.D.C.—It has been agreed to carry out a water supply scheme for Low Braithwaite, at an estimated cost of £82.

Sheffield T.C.—Tenders are to be obtained for increased coal storage at Neepsend, and also for coal-handling plant, at an estimated cost of £6,000.

Torquay T.C.—The corporation have for some time been gradually carrying out a considerable scheme of afforestation upon the catchment area at Tottiford, in proximity to the storage reservoirs. During recent years about 100 acres have been planted, and at present preparations are being made for clearing out the stock of trees from the nurseries. It is anticipated that the afforestation scheme will in the course of years yield a profit of about £1 per acre per annum.

MISCELLANEOUS.

Halifax T.C.—A motor ambulance is to be purchased at a cost of £175. The borough engineer, Mr. J. Lord, has received instructions to reconstruct the tramway track at North Bridge, at an estimated cost of £1,840.

Failsworth U.D.C.—Councillor Adah Schofield, at a recent council meeting referred to the fact that the surveyor, Mr. W. M. Shimmin, had asked his committee for consent to enlist with a view of leave of absence being granted. The committee could not see their way to grant the request, as all the work would have been at a standstill. All the other officials in that department had enlisted. The public might think the committee were not patriotic, but in view of the fact stated he thought they were justified. Councillor Elias Taylor said if all town and district councils had sacrificed as many men as they had there would have been many more in the Army than there were.

Westminster T.C.—A letter has been received from the Office of Works on the subject of the reduction of public lighting, in which it is stated that the use of flare lamps during heavy fog for lighting special points and areas is highly desirable.

FOR OTHER ADVERTISEMENTS
See End of Paper.

TWELVE-TON STEAM ROLLER for hire. For further particulars apply Borough Engineer, Municipal Offices, Cheltenham. (2,752)

PERSONAL.

Mr. W. J. R. Baker has resigned his position as engineer and manager of the Mansfield Corporation gasworks.

Mr. F. A. Furber, surveyor to the Quarry Bank Urban District Council, has had his salary increased by £20 per annum.

Mr. C. Jeffrey Vince, of the city engineer and surveyor's department, Birmingham, has been granted a commission in the Royal Engineers.

Mr. R. W. Hindhaugh, surveyor to the Ham Urban District Council, has been granted an increase of salary of £17 per annum on condition that he lives in the district.

Mr. H. J. Chapman, borough surveyor of Buckingham, has been appointed surveyor to the Hartshorne and Seals Rural District Council, at a salary of £150, in succession to Mr. N. Spence, who has been appointed borough surveyor of Marlborough.

Mr. F. Idiens, highways surveyor to the Stafford Rural District Council, has been commended by the Road Board for the valuable services he has rendered in connection with the construction and improvement of roads. The council have consented to Mr. Idiens receiving from the board a monetary payment in recognition of his services.

Lieutenant Richard Newman Somerville, R.E., who was killed in France on the 9th inst., was the eldest son of Mr. R. M. Somerville, of Osborne Park, Belfast, for many years county surveyor of Cavan. He was educated at the Royal School, Cavan, and graduated in arts and engineering at Trinity College, Dublin. He was a member of the University Officers Training Corps, and at the outbreak of war received a commission in the Royal Engineers. He had been in France three months.

Mr. E. B. Tomlinson, chief engineering assistant at the Windsor-street gasworks, is recommended by the Birmingham Gas Committee for the appointment of engineer-in-charge of the Nechells gasworks, at a salary of £600 per annum, rising to £800 by annual increments of £50, subject to approved service; and Mr. G. C. Pearson, the superintendent of the coal test plant at Nechells, as superintendent of the Windsor-street gasworks at a salary of £350 per annum, subject to his giving satisfaction to the committee in his new position.

Mr. R. O. Wynne-Roberts, M.INST.C.E., having relinquished his connection with the city of Regina, has commenced practice as a consulting engineer at 310 Temple-building, Bay-street, Toronto. Mr. Wynne Roberts is, we understand, engaged in writing a small book on waterworks, as applied to Canada, and is in want of photographs and particulars of automatic recording rain-gauges, water-level recorders, softening plants, filters, gas and oil engines, pumps, hydraulic mains, and other items for inclusion in the work. Perhaps some of our readers can render assistance in the direction indicated.

Mr. W. Ratcliff, assistant surveyor to the Merton Urban District Council, Mr. C. R. Plumtree, junr., assistant in the clerk's department, Mr. W. Sutton, junr., assistant in the surveyor's department, and Mr. H. May, assistant clerk, have been given permission to enlist in H.M. Forces. Mr. Ratcliff has been informed that the resolution as to payment of half salary to unmarried men did not apply to officers obtaining commissions, but his appointment is to be kept open, and he is to be paid such sum as may be necessary to bring his Army pay and allowances up to the amount of salary now paid him—viz., £140 per annum—provided any amount so paid does not exceed £70 per annum.

Mr. S. Spencer Haywood, borough engineer and surveyor of Brighouse, the author of the paper, "The Duties of a Municipal Engineer in the Present War," read at last Saturday's meeting of the Institution of Municipal and County Engineers, was in 1889 articled pupil to Mr. W. J. Newton, ASSOC.M.INST.C.E., borough engineer and surveyor, Accrington. He was appointed engineering assistant under Mr. H. A. Cutler, then engineer to the Rawtenstall Corporation (now city engineer, Belfast), and while occupying that position, among other things, acted as resident engineer on the joint main outfall scheme, and assisted in getting out plans for new fire station stables and a highways depot. In 1897 he was appointed deputy borough engineer and water engineer of Darwen, under the late Mr. R. W. Smith-Saville, and had charge of the carrying out of the following: Conversion of tramways to electric traction; laying a new tramway through fields to an outlying district; erection of refuse destructor, electricity works; hospital alterations; new recreation ground, &c. Mr. Haywood was appointed borough engineer and surveyor of Brighouse in 1901. While there he has carried out the following works: Widening county main road bridge (£4,000); erection of public baths and mortuary (£6,000); sewage scheme, alterations to sewage works, ten new 100-ft. diameter filters, tanks, &c.—work now in hand (£20,000); elec-

MR. S. SPENCER HAYWOOD,
Borough Engineer and Surveyor of Brighouse

tric transforming station; new chapel mortuary at cemetery; alterations to police court; additions to public offices; caretaker's house at park; schemes for refuse destructor, public market, recreation grounds, fire station, &c. It may be mentioned that he is Company Commander of the Huddersfield District Volunteer Corps.

In addition to the awards announced in April for papers read at the meetings, the council of the Institution of Civil Engineers have made the following awards for papers published in the "Proceedings" without discussion during the session 1914-15: A Telford Gold Medal to Mr. James Forgie (New York); Telford premiums to Messrs. J. B. Mason (Dunedin, N.Z.), Harold Berridge (Aden), C. R. White (London), C. S. Churchill (Roanoke, Va.); and the Trevithick premium to Mr. A. Poulsen (Lemvig, Denmark). The Indian premium for 1915 has been awarded to Mr. C. W. Anderson (Midnapore, India).

OBITUARY.

DEATH OF THE CITY SURVEYOR OF BATH.

Mr. Henry Robert Fortune, city surveyor of Bath, died, we regret to state, on Sunday at his residence, Harkley Villa, Oldfield Park, Bath. He had been city surveyor since 1888, and an official of the Bath Corporation for the past thirty-six years. Appointed in 1879 as road and street inspector, he became acting surveyor in 1885, and succeeded to the city surveyorship three years later. Many important street improvements were effected during his tenure of office, notably in the Dolmeads and at Lampards-buildings, where a scheme of artisans' dwellings was carried out under his direction. He was also responsible for the initiation of the sewerage and sewage disposal schemes which were completed by Mr. W. A. Rudford in 1914. Mr. Fortune interested himself in friendly society work, and was associated chiefly with the Hearts of Oak Benefit Society, of which he was elected president in 1897. He was seventy-one years of age, and leaves a widow (his second wife), two sons and two daughters.

The Monaghan Appointment.—The Local Government Board has for the second time declined to approve of the appointment of Mr. Hugh M'Cague, a mason, as engineer to the Monaghan Rural District Council. The matter has given rise to scenes at the council meetings, and after a heated debate at the last meeting a motion to adjourn the matter for some time was defeated, and Mr. Peter Finnegan was appointed to fill the vacancy for six months.

A WELL-KNOWN GLASS-MAKING FIRM.

One of the oldest and best known firms in the glass-making trade in this country are Messrs. Chance Bros. & Co., Limited, of Smethwick, Birmingham. At their works in that town the most up-to-date methods of glass manufacturing are to be found in operation, the very latest appliances being requisitioned in some of the newer lines lately placed on the market. When the date of the institution of this industry by the Chance family is taken into consideration the abnormal success of the company and the high standard of efficiency obtained is not surprising. The Chance family owned glass works near Bristol prior to 1793. In 1824 the business was extended by the establishment of the present works at Spon-lane, Smethwick, and the history of those works to a large extent tells the story of the window-glass trade in Great Britain.

It was Messrs. Chance who, in 1832, introduced into England the manufacture of sheet glass by the French method. This glass has gradually superseded Crown glass, which is now made only in small quantities for special purposes. It was in their works that all the glass for the Crystal Palace was made in 1851, and the sheet glass department is still one of the most important in the Smethwick works.

In 1848, under the auspices of the French manufacturer Bontemps, Messrs. Chance took up the production of optical glass for scientific purposes, and at the London Exhibition of 1862 they exhibited a pair of discs 25 in. in diameter, a remarkable achievement at that date. A good deal of attention is being paid to the manufacture of optical glass, and considerable development is taking place in this trade at the present time.

Of recent years the firm has been responsible for the introduction of figured rolled glass and other kinds of ornamental window glass, of which immense quantities are annually exported to all parts of the world. Rolled plate and rough cast glass is also manufactured on a very large scale, as also is coloured glass of all kinds, for railway signals and other uses. A new specialty is "Antitade" glass, which protects interiors from actinic rays, and is particularly valuable for picture galleries and aircraft sheds.

An important step was taken in 1850 by the establishment of lighthouse works, which for many years have formed one of the most important departments of the firm, and are the largest of their kind in the world. The works build lighthouses complete from the iron tower to the incandescent burners, and Messrs. Chance are the only manufacturers of lighthouse apparatus in the world who also make all the optical glass and lenses.

Mention should also be made of their rolled sheet glass, which was first introduced early in 1915 to meet the shortage of sheet glass. This is a semi-transparent glass, which is recommended as a satisfactory substitute for sheet glass for many purposes, and its advantages as compared with ordinary 21-oz. sheet glass will be apparent when it is stated that it transmits 6 per cent more light, is slightly thicker and stronger, and is obtainable in much larger sizes. For factories and workshops and in all kinds of horticultural work its utility will be obvious.

Messrs. Chance Bros., it may be added, in connection, have branch works at Glasgow, chiefly for the manufacture of rolled plate and figured rolled glass, especially useful for their immense export trade. They are closely associated with the famous Société de St. Gobain, Chauny et Cirey, the oldest and largest firm of plate-glass manufacturers in the world.

Birmingham Council House Extensions.
Over 40,000 sq. ft. of Chances' extra white cast glass glazed in the above building.

Tyrone Assistant Surveyors' Salaries.—An application of the Tyrone assistant county surveyors, numbering nine, for an increase of salary came up for consideration recently at the Finance Committee. Mr. William Stuart, assistant surveyor, Strabane, placed the position of the assistant surveyors before the committee, stating that it was fifteen years since the salaries of the assistant surveyors in Tyrone had been fixed, and since that time the work had vastly increased, as there were more traction engines and county machinery, while the cost of living had vastly increased, and the surveyors were obliged to pay their own travelling expenses out of the £100 a year they received. Mr. Stuart also pointed out that only the old existing surveyors were allowed to do extra work. Mr. Rodgers and Mr. Donnelly stated that it frequently happened all the surveyors were permitted to discharge extra duties, and that the condition that they were not to discharge other duties was not strictly in force. The committee discussed the question at length in private, and eventually decided to recommend that an increase be granted the assistant surveyors.

THE ABERDEEN WATER BILL.

The Bill of the Aberdeen City Council for acquiring an additional supply of water from the river Dee was the subject of an inquiry by a Parliamentary Committee at Aberdeen on Thursday, the 21st inst. Authority is sought to construct new waterworks and to take an additional supply of water from the Dee. The supply at present taken from the Dee is 8,000,000 gallons, and it is proposed to increase that quantity by 3,000,000 gallons. Provision is also made for purifying the water supply by the liming process, and the estimated cost of the whole works is £450,000.

Many petitions against the Bill were lodged, but the majority had been settled satisfactorily, and practically the only objection before the committee was that of the Dee fishery proprietors, who claimed compensation in the event of additional water being taken from the river.

The committee consisted of Lord Southwark (chairman), the Earl of Moray, Sir John M'Callum, M.P., and Mr. A. C. Morton, M.P. Mr. H. P. MacMillan, K.C., and Mr. Charles E. Lippe appeared for the promoters, and the petitioners were represented by Mr. R. S. Horne, K.C., Mr. John Wilson, K.C., and Mr. A. Morice Mackay.

CASE FOR THE PROMOTERS.

Mr. MacMillan opened the case for the promoters. There could be no two opinions as to the necessity for constructing new waterworks, and the other question was whether the Corporation of Aberdeen should be allowed to abstract the additional 3,000,000 gallons. The problem was a pressing one, and all the preparations and necessary investigations for presenting the scheme had been completed. They would be prepared, however, having obtained a decision, to postpone the actual expenditure of money until the present financial stringency had been relaxed. Mr. MacMillan contended that the abstraction from the Dee of an additional 3,000,000 gallons per day would not prejudicially affect the river from the fishing point of view, that the provision of compensation water was unnecessary.

Mr. Cecil H. Roberts, water engineer for the Aberdeen Corporation, stated that he found an average of from 500,000 to 1,000,000 gallons of surface and other water finding its way in through the roof of the aqueduct and mixing with the supply from the Dee. A greater quantity was coming out than was going in at the intake. He contended that the abstraction of an additional 3,000,000 gallons from the Dee would not appreciably affect the flow of the river. By shutting off the supply altogether he found the surface of the river fell only ½ in., and if 3,000,000 gallons additional were taken it would only affect the surface of the river by $\frac{3}{16}$ in.

Mr. Roberts, in cross-examination by Mr. Horne, K.C., stated that, doubtless, with sufficient storage provision, an increased supply from the Dee might not be necessary.

The Woolwich Housing Scheme.—The development of the Government housing estate at Woolwich continues, and over 800 wooden huts, each of four rooms, are now to be built. The London County Council proposes to build a new school for the children on the estate.

British Columbia's Forest Products.—The Government of British Columbia is making every effort to secure wider markets for the forest products of the province. In connection with this movement there are being issued pamphlets intended for distribution to lumber buyers and consumers throughout the world. These are entitled: (1) "British Columbia Timber," (2) "British Columbia Red Cedar Shingles," (3) "How to Finish British Columbia Wood." Copies of these pamphlets may be obtained free upon application to the Agent-General for British Columbia, Salisbury House, London, E.C., the Canadian Trade Commissioners throughout the world, and the Forest Branch, Victoria, B.C.

FERRO-CONCRETE BRIDGE BUILDING IN ESSEX.

One of the numerous highway bridges built for the Essex County Council in replacement of brick and timber structures which by reason of decay or other causes have been found inadequate for modern road traffic is illustrated in the October issue of *Ferro-Concrete*.

Ackingford Bridge, as it is called, takes the place of an old timber structure over Cripsey Brook, near Ongar, and carries the main road between Epping and Chelmsford. The former bridge was only 14 ft. wide, rendering necessary a narrowing of the roadway and the suppression of the footpaths at each approach. The new bridge is 31 ft. wide between parapets, having a 21-ft. roadway and two 5-ft. footpaths, thus permitting an important highway improvement to be effected.

The bridge was designed by Mr. Percy J. Sheldon, M.INST.C.E., the county surveyor, and constructed

Ackingford Bridge, Essex.

entirely in Mouchel-Hennebique ferro-concrete from working drawings prepared by Messrs. L. G. Mouchel & Partners, Limited, of Westminster.

The bridge was calculated for the rolling load of a 30-ton boiler trolley with a wheel base of 10 ft. by 7 ft. 6 in., and when officially tested was found to carry the specified load without appreciable deflection or vibration. The contractors were Messrs. J. Garrett & Son, of London.

INSTITUTION OF CIVIL ENGINEERS.

The ninety-seventh session of the Institution of Civil Engineers will be opened on Tuesday next, at 8 p.m., when Mr. Alexander Ross, president, will deliver an address, and will present awards made by the council for papers read and discussed or otherwise dealt with during the past session.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SURVEYOR AND INSPECTOR.—October 30th.—Salcombe Urban District Council. £70 a year.—Mr. C. E. Turner, clerk, Salcombe, Devon.

ENGINEER.—November 1st.—Required for service at the Imperial Bacteriological Laboratory, Muktesar, India, engineer with electrical and mechanical training, workshop experience, and knowledge of wiring, motors, and high-speed centrifuges.—Director-General of Stores, India Office, Whitehall, London, S.W.

INDUSTRIAL DEVELOPMENT OFFICER.—November 1st.—Corporation of Nottingham. £250 a year.—Mr. W. J. Board, town clerk.

FOREMAN MAIN AND WATER INSPECTOR.—November 1st.—Gosport Waterworks Company. £150 per annum.—Mr. E. T. Hildred, waterworks engineer, 4 High-street, Gosport.

GAS ENGINEER AND MANAGER.—November 3rd. Hebden Bridge and Mytholmroyd Gas Board. £200 a year.—Mr. R. Crabtree, clerk, Hebden Bridge.

SANITARY INSPECTOR.—November 5th.—Dore Rural District Council.—Mr. R. Moore, clerk, 8 St. John-street, Hereford.

BOROUGH SURVEYOR.—November 12th.—Corporation of Buckingham. £150 a year.—Mr. Geoffrey M. Barker, town clerk, Buckingham.

ENGINEER-IN-CHARGE. — November 22nd.—Thakeham Rural District Council. 32s. per week.—Mr. Percy Ayling, clerk, Council Offices, Storrington, Sussex.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

YORK. — November 30th.—Schemes under the Housing and Town Planning Act, 1909, in connection with certain areas within and without the city of York, for the corporation. Premiums, £100, £50 and £25.—Mr. F. W. Spurr, city engineer, Guildhall, York.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

HULL.—November 2nd.—For the erection of sanitary conveniences annexe, for the guardians.—Mr. T. B. Atkinson, architect, Trinity House Chambers, Trinity House-lane, Hull.

DARTFORD.—November 3rd.—For the erection of seventy-two houses, for the urban district council.—The Surveyor.

GLAMORGAN.—November 8th.—For the adaptation of and repairs to house and outbuildings, for the county council.—Mr. T. M. Franklen, clerk, County Hall, Cardiff.

CASTLEBAR.—November 6th.—For the erection of four bridges to cottages, for the urban district council.—Mr. F. Ryan, acting clerk.

EDMONTON.—November 9th.—For the erection of a cleansing station, for the urban district council.—Mr. Cuthbert Brown, engineer.

ST. HELENS.—November 17th.—For the erection of an engine-house and other works, for the Electricity Committee.—Mr. E. M. Hollingsworth, borough electrical engineer.

KILKENNY.—November 30th.—For the construction of a reinforced-concrete bridge, for the Kilkenny and Wexford County Council.—Mr. A. M. Burden, county surveyor, Kilkenny.

Engineering: Iron and Steel.

LANARK.—November 1st.—For executing electric lighting works, for the District Committee of the Middle Ward.—Mr. W. E. Whyte, district clerk, District Offices, Hamilton.

GODALMING.—November 2nd.—For sinking and lining a borehole, for the corporation.—Borough Surveyor.

SWANSEA.—November 3rd.—For laying a new water main across the bed of the river Tawe, for the corporation.—Waterworks Engineer, 13 Somerset-place, Swansea.

TOTTENHAM.—November 3rd.—Tenders invited for the purchase of an Aveling & Porter 12-ton steam roller.—R. C. Graves, clerk, Town Hall.

LONDON.—November 3rd.—For an electrical installation at a school, for the London County Council.—Chief Engineer, County Hall, Spring-gardens, S.W.

FRASERBURGH.—November 6th.—For the construction of a corrugated steel and timber lifeboat-house and concrete slipway, for the Royal National Lifeboat Institution.—Mr. J. Wallace Tarras, Town House, Fraserburgh.

EDMONTON.—November 9th.—For the supply and erection of a vertical steam boiler, and re-erection of disinfector, with necessary steam piping and accessories, for the urban district council.—Mr. Cuthbert Brown, engineer, Town Hall, Edmonton.

LONDON.—November 10th.—For the supply of steam and hot-water heating accessories, for the Commissioners of Public Buildings.—Controller of Supplies, Office of Public Works, 18 Queen Anne's-gate, Westminster, S.W.

SOUTHAMPTON.—November 12th.—For the supply of about 9 tons of rolled steel tees and channels, for the corporation.—Waterworks Engineer, 33-35 French-street, Southampton.

MADRAS.—December 16th.—For the supply and delivery of 15-ft. diameter cast-iron wall sluices, with gun-metal faces, adjustable wedge blocks, pillars and headstocks, for the corporation.—Messrs. James Mansergh & Sons, agent, 5 Victoria-street, Westminster, S.W.

ATHENS.—December 17th—30th.—For the maintenance and working of the undertakings necessary for the water supply, and laying a distributing system.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

JOHANNESBURG.—December 30th.—For the supply and erection of ice-making and refrigerating plant, for the municipal council. — Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

Roads.

ALDERSHOT.—November 2nd.—For the supply of 500 tons of Clee Hill, Devon or North Wales basalt, and 200 tons of tar-macadam.—Mr. F. C. Uren, surveyor.

FAREHAM.—November 4th.—For the construction of a road, for the rural district council.—Mr. J. F. Whitear, surveyor, 16 Southampton-road, Fareham.

EASTBOURNE.—November 8th.—For making up certain passages, for the corporation.—Mr. A. E. Prescott, borough surveyor, Town Hall.

NORWICH.—November 9th.—For the supply of granite for the year ending December 31st, 1916, for the county council.—Mr. T. H. B. Heslop, county surveyor, The Shirehouse, Norwich.

Sanitary.

ABERDEEN.—November 2nd.—For the construction of 50 yds. of pipe sewer, with ventilating manhole, for the corporation.—The Surveyor, Town House.

Stores.

BRADFORD.—November 13th.—For the supply of materials for the tramways department.—Tramway Offices, 7 Hall Ings, Bradford.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.
‡ Provisionally accepted.

ELTHAM.—For the supply of granite, for the urban district council. Mr. G. Stevens, surveyor:—

Dosthill Granite Company, Dosthill, near Tamworth. ¾ and ½ in., 11s. 6d. per ton; 1¼ in., 12s. 10d. per ton; 1½ in. and 2½ in., 13s. 6d. per ton.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

NOVEMBER.

1.—Royal Institute of British Architects: President's opening address. 8 p.m.
2.—Institution of Civil Engineers: President's address; presentation of premiums. 8 p.m.
3.—Birmingham and Midland Institute Scientific Society: Mr. Harry Jackson, ASSOC.M.INST.C.E., on "Reinforced Concrete." 7.30 p.m.
3.—Institute of Sanitary Engineers: Mr. James Menzies on "Disposal of Nightsoil by Distillation."
5.—Town Planning Institute: Mr. J. S. Birkett on "Limited Owners and Town Planning." 92 Victoria-street, S.W. 6 p.m.
8.—Surveyors' Institution: Mr. J. H. Hanson delivers his presidential address. 8 p.m.
10.—Chadwick Public Lecture: Mr. Saxon Snell on "Emergency Military Hospital Construction." Royal Institute of British Architects. 8.15 p.m.
17.—Chadwick Public Lecture: Mr. W. E. Riley on "Some Conclusions on Housing our Workers." Royal Sanitary Institute. 8.15 p.m.

DECEMBER.

1.—Institute of Sanitary Engineers: Dr. W. E. Adeney on "The Disposal of Sewage by Dilution: A Bio-Chemical Method."

APPOINTMENTS OPEN.

BOROUGH OF BUCKINGHAM.
APPOINTMENT OF SURVEYOR, &c.

The Town Council invite applications for the office of Borough Surveyor, Inspector of Nuisances, &c.

The person appointed will be required to reside in Buckingham, and to devote his whole time to the performance of the duties of the several offices, and he will be required to give security. He will also be required to give a calendar month's notice in writing in order to determine his appointments under the Council.

Annual salary, £150.

Applicants must hold the certificates of the Royal Sanitary Institute and Institution of Municipal and County Engineers.

The appointment as Inspector of Nuisances will be made subject to the approval of the Local Government Board.

Applications, stating age, marital condition, and previous experience, and accompanied by not more than three testimonials of recent date, to be sent to me on or before Friday, the 12th November, endorsed "Surveyor."

Further particulars may be obtained on application to me.

Selected candidates will have notice to attend on the day of election, and their reasonable travelling expenses will be paid.

Canvassing will be deemed a disqualification.

GEOFFREY M. BARKER, LL.B.,
Town Clerk.

Buckingham.
October 26, 1915. (2,750)

ENGINEERING ASSISTANT required at once for an Urban District Council within 10 miles of London.

Must be good draughtsman and surveyor with municipal experience.

Only men who are ineligible for His Majesty's Service need apply.

Box 1,546, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (2,751)

THAKEHAM RURAL DISTRICT COUNCIL.
STORRINGTON WATER SUPPLY SCHEME.
APPOINTMENT OF ENGINEER-IN-CHARGE OF PUMPING STATION.

The above-named Council will shortly require the services of an Engineer to take charge of the Pumping Station, and to discharge the duties of Inspector of Mains and Fittings in connection with the Water Supply to the Parish of Storrington.

The Pumping Plant consists of two Tangye oil engines and deep borehole pump.

Salary 32s. per week inclusive.

Candidates should have had experience in similar work.

Applications, marked "Engineer," accompanied by not more than three testimonials, to be sent to the undersigned not later than 10 a.m. on Monday, November 22nd, 1915.

Canvassing will be deemed a disqualification.

(By order)
PERCY AYLING,
Clerk.

Council Offices,
Storrington, Sussex.
October 26, 1915. (2,748)

TENDERS WANTED.

NORFOLK COUNTY COUNCIL.
TENDERS FOR GRANITE—1916.

The Norfolk County Council invites Tenders for the Supply of Granite for the year ending 31st December, 1916.

Full particulars can be obtained from the undersigned.

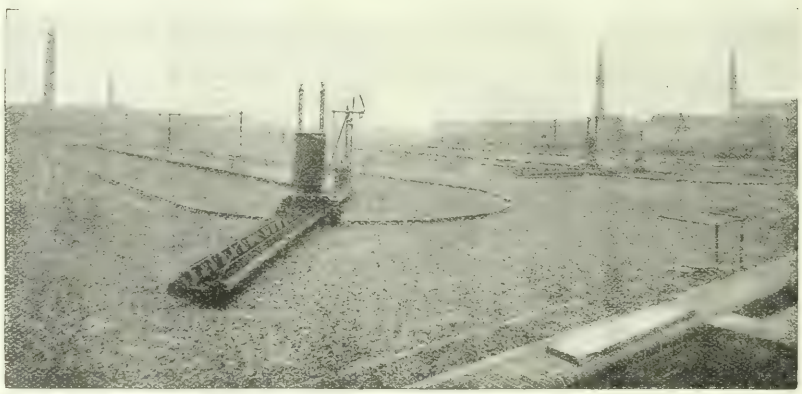
Tenders to be delivered not later than the 9th November, 1915.

T. H. B. HESLOP,
County Surveyor.

The Shirehouse,
Norwich.
October 20, 1915. (2,747)

"J. and A." Sewage Distributors

Waterwheel or Power-driven Types



Installation electrically-driven; each distributor capable of sprinkling 1,200,000 galls. per day with 1 B.H.P. and less than 12 in. loss of head.

Continuous drive with uniform intervals between doses.
Greatest economy in current.

Jones & Attwood, Ltd., Hydraulic Engineers, Stourbridge.

Telegraphic Address—"HEAT, STOURBRIDGE." Telephone No. 10.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. NOVEMBER 5, 1915. No. 1,242.

Minutes of Proceedings.

Methods of Water Sterilisation.

A paper on the various methods of water sterilisation and the extent and results of their application could only be written after the necessary statistics had been collected. As these particulars would have to be gathered from many countries, and as much of the matter of interest would relate to armies in the field, a comprehensive review is impossible. There is, however, sufficient evidence at hand to show that the methods developed during the last few years are very widely and generally applied, and there can be no doubt that the sterilisation of water is one of the important factors which have lowered the rate of casualties due to sickness [illegible] commencement of the war. It is very desirable that particulars should be gathered and brought to light, and for this reason we welcome a paper on the purification of water by disinfection written by Mr. W. H. Dittoe, engineer to the Ohio State Board of Health, which has appeared in the journal published by that authority.

In reviewing the various methods now in use, the author shows that chlorine treatment of water is by far the most important, owing to its economy and to the proof afforded by its wide application. No fewer than 300 cities in America have adopted chlorine treatment for water in one form or another since the year 1908. Portable plants are used by various municipalities for emergency treatment of supplies when outbreaks of typhoid fever occur, and this portable plant can also be used by armies in the field. Other methods have their uses, however, and it is not to be assumed that chlorine treatment is the remedy for all evils. Taking the methods in order, the author first draws attention to sterilisation by heat. Small supplies of boiled water have been found very satisfactory, and attention is drawn to the case of the World's Fair at Chicago in the year 1893, when 15,000 employees were supplied with boiled drinking water. Again, there are the instances of supplies of distilled water, such as at Troon, in Scotland, at Perim and Kossier, on the Red Sea, and at several South American cities. Treatment of water with copper salts has been found to be more useful in getting rid of algal growths than for bactericidal purposes, and in the author's opinion copper treatment is not [illegible] method of sterilisation. Permanganate of potash, used for the treatment of small supplies in India, and [illegible] War, is stated to be of doubtful efficiency, and to be too costly for the treatment of municipal supplies. It might also be added that the unpleasant taste and colour of the water are sufficient to render the method impracticable for such purposes. The author seems to have a poor opinion of the ozone treatment. It has found little favour in America, and in spite of the European installations, such as Paris and Petrograd, it does not seem to make much headway at the present time. Other methods are less costly and quite as efficient; in the author's opinion they are more efficient.

With regard to chlorine there are now several methods; calcium hypochlorite and sodium hypochlorite solutions are generally used, and there are a growing number of cases where chlorine gas compressed into liquid form is used. The quantity of chlorine, in either form, used in America varies, we are told, from 0·2 part per 1,000,000 to 2 parts per 1,000,000, the latter being used for the treatment of turbid water. For clear water 0·5 part per 1,000,000 is generally found to be sufficient. The liquid chlorine or chlorine gas is sold in steel cylinders holding about 100 lb. to 125 lb. of the liquid chlorine at a pressure of about 100 lb. per square inch. The efficiency of this method is established both by analytical results and by the typhoid fever statistics. With regard to the lime treatment advocated by Dr. Houston for the London supply, and used by Mr. Hoover for the Columbus supply, it is to be [illegible] dose of lime as a germicide, Mr. Hoover considers that, if sufficient lime is added to remove the carbonic acid from the water, such neutralisation of the carbonic acid is in itself sufficient to destroy the harmful organisms. The author considers the lime method too costly for general application. For the same reason he considers that the ultra-violet ray treatment is impracticable. Thus it appears that the chlorine method must in the majority of cases be most suitable for water disinfection, but it must be remembered that it is only suitable as an adjunct to filtration unless the water is free from organic matter in its raw state. Otherwise it is only suitable as an emergency method, and in such cases the cost of treatment must be higher, for the water will need a larger dose of chemical, and will probably not be free from tastes and odours without dechlorination.

Engineers and the War.

Mr. Alexander Ross, the new president of the Institution of Civil Engineers, delivered his inaugural address on Tuesday last, and it was only natural and completely appropriate that it should have consisted in part of an appreciation of the work of engineers in connection with the war. This has been called an engineers' war, and a comparison of the weapons and munitions of the present day with those of a hundred years ago amply justifies the description. For all this progress engineers are responsible, and the fact that, like Hal o' the Wynd, they do not themselves shrink from using the weapons they have forged is proved by the number of members of the institution—some 1,500 in all—who have joined his Majesty's Forces. Many of those, however, who find themselves unable to take any active part in the great conflict have had to endure great sacrifices, while not a few have been reduced to actual distress. In this connection Mr. Ross emphasised the fact that professional engineering work has been adversely affected to an extraordinary degree by the need, which is realised by all, of husbanding the national resources and arresting the prosecution of a large number of those undertakings which in the usual course employ professional engineering skill. But, while sharing the view that much expenditure and application of labour which is not directed to military needs should be suspended for the present, he doubted whether it was a truly economical course to postpone, even under the present circumstances, the contemplation and professional consideration of engineering works, for which the call may be expected to be acute when the war is over.

The latter portion of the address was devoted to a discussion of the question whether we are, as a nation, making the most of our national resources from an economic point of view, especially as regards some matters that particularly interest the engineer. The typical example selected was that of iron and steel, and inasmuch as the prosperity of the iron and steel industry of a country may be taken as a measure of the prosperity of the nation itself, this was quite an appropriate choice. It appears from statistics given by Mr. Ross, and based upon Parliamentary returns, that Great Britain has not made the same rapid advance as some other countries in the matter of production in recent years, but on the other hand it is eminently satisfactory to know that British iron and steel occupy the highest position as regards quality, and that we are keeping abreast with respect to the higher class steels. Mr. Ross's able review of the economic resources of the country is of special value at the present time in view of the problems of employment that are bound to arise with the return of our armies from the Front. It is to be hoped that the authorities will institute inquiries into these matters without delay, so that they may be prepared to commence relief works of utility of all kinds as soon as our gallant soldiers return.

Municipal Progress in Calcutta.

The report of the municipal administration of Calcutta, which is summarised in a recent issue of *Indian Engineering*, is interesting reading from the point of view of finance and general progress. The statement of income and expenditure is quite satisfactory, judging from the comfortable balance left over, and it is recorded that a "good thing" has been made out of the sale of surplus lands, mostly on the new roads in the Fringe area, and around Maddox-square. This item has yielded such excellent results that improvements promise to cost but little to the municipal authority. The policy of selling municipal land is, we should think, a doubtful one, especially where the prospect of higher values is so well assured as would appear to be the case in Calcutta. With respect to public improvements it is stated that over 1 mile of road has been opened out, sewered and constructed, twenty-nine latrines and three bathing platforms have been provided, and huts have been removed from twenty-nine insanitary areas. In the lighting of the city the standard continues to advance. Inferior lamps are being replaced by better types both on the streets and public institutions, and the electric light has been definitely installed in certain areas, and will be eventually extended before long to others. The allowance of water per head of the population can only be regarded as extremely liberal, consisting as it does of 32·8 gallons for filtered and 27·4 gallons for unfiltered water. This consumption marks about the limit of the present capacity of the works, and any increase would necessitate considerable additions to the system. The road works include the laying of Burn's wire-cut bricks on a concrete foundation; an experimental track of reinforced concrete by Messrs. Turnbull, of Glasgow; the construction of wood block paving over cement concrete; and the treatment of certain roads with tar-macadam. This latter experiment is described as a distinct success. The death-rate for the suburbs was 35·3 per 1,000. The mortality is chiefly among the Indians, the rate among the Europeans being, "as usual," insignificant. The difficulties of sanitary improvement among the native population are, of course, very real, but in spite of this the progress made is gratifying, and our Indian contemporary is, judging from the facts recorded, well justified in claiming that Calcutta, in the tropics, is not necessarily a more deadly place to live in than London in the temperate belt.

* * *

Negligence: Liability of Contractor.

The case of *Elliott* v. *C. P. Roberts & Co., Limited*, in which a reserved judgment was given last week by Mr. Justice Lush, raised a question of considerable importance as to the extent of the duty of a contractor in regard to the safety of an independent tradesman employed by the building owner to do special work on a building in course of erection. At the conclusion of the hearing it was intimated that there would be an appeal to the Court of Appeal, so that we cannot do more at present than merely record the facts and decision of the Court of first instance. The defendants, who are the well-known contractors of Dalston, had entered into a contract with the London County Council for the rebuilding of one of their schools, one of the terms of the contract being that they should afford facilities to any other tradesmen employed by the council, including the reasonable use of any scaffolding. At a considerable height Messrs. Roberts had placed across an open space a gangway consisting of two planks. This had been used by workmen for about three months and for some weeks by the plaintiff himself without mishap. On the occasion in question, however, the plaintiff was walking across the gangway when he fell some distance and sustained serious injuries which resulted in paralysis. The action was founded upon the alleged negligence of the defendants in not providing a safe and suitable gangway, properly secured so as to prevent it from slipping, and the jury found for the plaintiff and assessed the damages at £2,000. Upon this verdict legal argument took place, with the ultimate result that the learned judge gave judgment for the defendants, on the ground that in law they were under no duty to the plaintiff to provide a gangway which was safe in fact, their only obligation being not to expose him to any hidden trap. The obligation was held to be limited in this way because the plaintiff was not employed by the

decisions, if it was there any contract between them. The result of the appeal will be awaited with interest, not only by builders and contractors, but also by surveyors and others having occasion to visit or move about on buildings in course of erection.

A Double Appeal.

Second to none in the amount of good work has been accomplished by the Professional Classes War Relief Council that, in spite of the exercise of every possible economy in administration, there is at the present time a considerable strain upon their financial resources. To put the case shortly, unless the work is to suffer more money is needed, and inasmuch as support from the national funds will only be given in proportion to the amounts which are obtained from private sources, it has been decided by the council to organise a large effort for the purpose of obtaining increased voluntary support. This effort will take the form of a great Christmas in War-time sale to be held next month at the Royal Albert Hall. Royal patronage has been secured, and committees representing the different professions have been set up with the object of securing the widest possible interest in the venture. Among these committees is one representative of the surveying profession, and we understand a letter from Mr. Alexander Goddard, the secretary of the Surveyors' Institution, who is acting as honorary secretary, in which he solicits the active support of our readers and their friends. This support is required in two main directions—namely, by providing articles for the stalls, and by endeavouring to secure a good attendance. To those who are familiar with the past successes of the leaders in organising the sale is to be held it will be unnecessary to emphasise the urgency of both these appeals. As Mr. Goddard says in his letter, the success of so great an enterprise must depend upon its receiving the whole-hearted support of the entire class for whose benefit the fund is being raised. The undertaking provides a splendid opportunity for surveyors to assist their professional brethren who are in distress owing to the war, and we have no doubt that the response to Mr. Goddard's appeal will be worthy of the great profession which his committee represents.

State Control of Sanitary Administration.

At the annual meeting and conference of the Sanitary Inspectors' Association, which was held in London last week, a paper was read by Mr. C. H. France, the chief sanitary inspector of Wigan, which had for its object the advocacy of some system of State control of sanitary administration. The main contention—and the duties of a sanitary inspector are national in character, and that so long as such an officer is under the jurisdiction of a local authority, the nature of his duties is such as to render it probable that he will come into direct conflict with some of the members. The advantages claimed for State control were first that the public would secure uniformity of inspection, and second, that the inspector would secure a higher status as a public servant, and would probably enjoy the benefits of superannuation. We have a good deal of sympathy with the main contentions of the paper. We may, perhaps, be permitted to point out, however, that many of the reasons advanced for the State control of sanitary administration apply with equal force to the department of the municipal engineer. The nature of *his* duties, too, is likely to bring him into direct conflict with individual members of his authority—and indeed it often does so. In such a case the only difference between the sanitary inspector and the municipal engineer is that the latter can be dismissed without reason assigned, whereas the former has already some measure of Government protection. If the sanitary administration of the country is nationalised, the Local Government Board should be strongly pressed to deal at the same time with the municipal engineer's grievance of insecurity.

* * *

The Salcombe Surveyor's Salary.

Some correspondence has appeared in the *Western Morning News* with respect to the salary which the Salcombe Urban District Council are offering to their new surveyor and sanitary inspector. Seventy pounds a year for the services of a professional man in these capacities in an urban district seems to us a totally inadequate remuneration, and it is not at all surprising to find the local authority accused bluntly of sweating. The vice-chairman rushed into print with a defence of the council, but he might have reserved his energies for a more deserving cause. He says that the appointment is for part time only, the successful applicant being allowed to carry on his own private business. "Part time" may be a very fascinating phrase to the worthy vice-chairman—as fascinating as that blessed word "Mesopotamia was to the elderly lady—but it would be interesting to know how it works out in practice in what the councillor describes as "a rising place like Salcombe." It seems to us that if justice is to be done to the dual offices of surveyor and inspector, there is little probability of other than private leisure being available for the discharge of private business. Any way, it is not quite worthy of the Salcombe Council, or the council of any other "rising place," to put forward the argument, as the vice-chairman does in this instance, that, as such towns are stepping-stones to better positions, the office of surveyor and inspector may be remunerated with what is little better than a pittance. Such an argument amounts to little less than a pretext for levelling down salaries.

* * *

The Reporting of Meetings.

At the recent meeting of the North-Eastern District of the Institution of Municipal and County Engineers at Brighouse a resolution was passed which will have the effect of excluding the representatives of the Press from future meetings of the district. The chief reasons advanced in favour of this important change were that there would be greater freedom of discussion in the absence of reporters, and that the younger members would not be so diffident in speaking. It occurs to us that the former of these objects might have been achieved without making so drastic a change as that effected by the resolution. Whether the younger members will be induced to speak more freely in the absence of the Press remains to be seen, but in our opinion it is open to great doubt. On the whole, we are unable to congratulate the members of the North-Eastern District on the step they have taken, which we regard as retrograde in spirit. One thing is certain, by the publication of an official report only they will lose some of that publicity which is so important for societies of all kinds to cultivate if they are to maintain their position. We hope that the North-Eastern District may be induced to reconsider their decision, or at least that their example will not be followed.

Tar-spraying in Elgin. In a report presented to the town council at their last meeting, Mr. Acton A. Turriff, burgh surveyor, stated that the area of roadways in Elgin tar-sprayed during last season was 110,032 sq. yds., an increase of 10,332 sq. yds. as compared with the previous year, and that the total cost of the work was £290 14s. 8d., or 6·36d. per square yard as against 5·8d. last year.

The Spa Sewage Works, Ossett.

By H. HOLMES, M.Inst.C.E., Borough Surveyor and Waterworks Engineer of Ossett.

[The opening took place recently of extensions of the Ossett Corporation's sewage works at the Spa outfall. The sewerage of the district is, generally speaking, on the combined system, and the whole of the sewage, with the exception of that from a few cottages, gravitates to two outfalls—the southern outfall at Healey and the eastern outfall at Spa.]

The old outfall works were designed by Mr. Malcolm Paterson, M.Inst.C.E., of Bradford, in 1873, 1874 and 1875. The works consisted of three settling tanks and 2 acres of land.

In 1896 Mr. Paterson submitted and carried out a scheme for the extension of these works, which included screening tanks and overflow chamber, liming shed and mixer, four settling tanks, sludge filters, and macadamised area for storage of dried sludge, and the laying out of additional areas of land on the pane and gutter filter-bed system. In 1907 Mr. W. E. Putman submitted and carried out a further extension to these works—viz., extension to lime-house, office, six settling tanks with inlet and outlet carriers, three 100-ft. diameter percolating filters, varying in depth from 6 ft. 9 in. to 8 ft. 9 in., humus pits, sand and clinker secondary beds—cost, £8,559. The Local Government Board stated in September, 1908, that they would be prepared to accept this scheme as an instalment of what will ultimately be necessary, provided that certain modifications were made. On October 26, 1911, the Sanitary Committee instructed me to prepare a complete scheme capable of turning out a final effluent satisfactory to the West Riding Rivers Board. The scheme was submitted to the Sanitary Committee in January, 1913, when a resolution was passed approving of the scheme submitted. The Local Government Board's sanction and approval were obtained in December, 1913.

Description of the New Works.

Previous to commencing the new extensions it was necessary to reconstruct the main outfall sewer, 2 ft. 9 in. in diameter, for a distance of 515 lin. yds., with a gradient of 1 in 450. This sewer is constructed with a 4½-in. ring of blue Staffordshire radiated bricks, ½-in. collar joint, surrounded with 6 in. of 6 to 1 Portland cement concrete.

Two new screening and detritus chambers have been constructed, fitted with Messrs. Stott Bros.', of Haslingden, sewage screen, which are worked by hand. Each chamber has a sloping floor for the deposition of mineral matter and grosser solids.

A storm-overflow chamber adjoins the above on the works side of the screens, constructed with fixed blue-brick cills to take the excessive storm water above three times the dry-weather flow.

The Local Government Board insist that up to three times the dry-weather flow should be treated as sewage; three to six times to be treated as storm water, either on land or in storm-water tanks; above six times may go direct to the stream or river. The storm water is conveyed through a carrier 2 ft. 6 in. by 2 ft., or through a duplicate culvert 24 in. diameter, constructed of concrete tubes, to a storm-water tank, 114 ft. by 56 ft. wide, built of red brickwork, with red brick coping and Portland cement concrete floor. The tank is fitted with scum boards and floating arm for running off the top water after the tank is out of action. The sludge is run off through a valve into a sludge well adjoining, and pumped on to a sludge lagoon, which will be afterwards described.

The sewage from the screening chamber passes through the liming-house, where it receives its proper quantity of milk of lime (the water-wheel which drives the lime-mixer acts as an agitator), and then passes along channels to the continuous-flow settling tanks. The new settling tanks are two in number, and have a capacity of 103,500 gallons. These tanks have an average depth of 4 ft. 7 in. to top-water level. The walls are built of red brickwork with blue Staffordshire bull-nosed copings. The floor is constructed of Portland cement concrete, 6 to 1, with channels for running off the sludge, which is controlled by a sluice valve, and thence through a 9-in. cast-iron pipe to the sludge well. Copper floating arms are provided for running off the top water before sludging. The new tanks are so arranged with the old tanks that they can be used collectively as one tank, or individually controlled by means of penstocks fixed at the ends of each tank, thus enabling the process of cleaning out to be carried on without materially interfering with the flow of sewage. The tank effluent from the two additional tanks is then conveyed through a 15-in. cast-iron effluent main into an existing feed carrier which has been partly reconstructed. A new length of 134 lin. yds. of feed carrier has been constructed, 3 ft. by 2 ft. 6 in., with the necessary penstocks. From this carrier the tank effluent passes into the dosing chambers.

Each chamber is 8 ft. by 8 ft., and has a water capacity of 550 gallons. Messrs. Ames-Crosta automatic discharging apparatus is fixed in each chamber. The apparatus is worked by a float, which automatically breaks and forms the syphonic action, the rate of which action naturally varies directly as the flow of sewage.

Four new percolating filters have been constructed (making seven in all), 100 ft. each in diameter. The effluent passes from the dosing chamber to the filter through a 10-in. cast-iron pipe, and is distributed over the filter by means of Messrs. Ames-Crosta revolving sprinklers. The outlets in the arms are fitted with brass nipples. Each sprinkler is provided with a 3-in. wash-out pipe and sluice valve, for the purpose of cleansing. The beds are dosed intermittently.

Each filter is 6 ft. deep, built upon a concrete base 9 in. in thickness. The floor is divided into four, and provided with two channels. Half the bed drains to one channel and half to the other. The advantage of this method is to get short, sharp falls on the floors, so that it would be impossible for any humus or gritty matter to lodge on the floor. The walls are built of 14-in. red brickwork to half the height, where a special blue Staffordshire plinth brick reduces the work to 9 in. for the rest of the height, and are completed with a blue Staffordshire bull-nosed coping. The floors of the filters are covered with Messrs. Naylor Bros.' tiles, specially made for filters. The medium consists of graded destructor clinkers, produced at the corporation destructor works, and honeycomb slag from Ardsley, graded in sizes from 2 in. to 3 in. at the bottom to ½ in. to 1 in. at the top of the filter. On the top of the tiles I had 12 in. of gravel, varying in size from 3 in. to 6 in., spread over the tiles; I find by experience that by putting in gravel next to the tiles the drainage from the bed is very much improved.

The tank effluent having passed through the filters, the resultant effluent is collected in one main collecting channel 3 ft. by 3 ft., running the whole length of the filters. At each end of this channel penstocks are fixed, and the effluent can either be dealt with on the old filtration areas, or turned on to the new filtration area, 3½ acres in extent, which has recently been underdrained and covered with a layer of ashes 7 in. thick and ploughed in; 260 lin. yds. of feed-carrier, varying in size from 2 ft. by 1 ft. 6 in. deep to 1 ft. by 1 ft., has been constructed on this area. The underdraining of this area is done on the herring-bone principle. The effluent percolates through the ground to the underdrains, which discharge into a main effluent drain 15 in. in diameter, and thence finally discharges into the beck.

Six hundred lin. yds. of unclimbable iron fencing and 689 lin. yds. of post and rail fencing have been erected.

The new tanks and filters have now been at work twelve weeks, during which time the effluent, which is clear and bright, has gradually improved, at any rate so far as appearance is concerned.

The large amount of surplus dust left after riddling the clinker for media for filters has been utilised by spreading it over the land filters, thereby greatly increasing their efficiency.

Sludge Disposal.

In order to utilise 2½ acres of land for the disposal of sludge it was necessary to divert the beck, whose course ran in a very irregular manner through this land. This diversion, 198 lin. yds. in length, consisted of one straight length of concrete tubes, 27 in. in diameter, and haunched with 6 in. of 6 to 1 Portland cement concrete.

This particular land forms a valley, and, by form-

ing tanks at each end, a very convenient site for the disposal of liquid sludge is made, which has already proved a great saving to the town.

The works are so designed that the sludge from the whole of the tanks, old and new (fifteen in number), gravitates to the new sludge well, from where it will be pumped up by a 4-in. Stereophagus sludge pump, capable of pumping 12,000 gallons of sludge per hour. This type of pump was designed by the Hon. R. C. Parsons, for raising liquids containing large quantities of solids. It is provided with blades, which, it it is claimed, break up solid matters, such as wood, coke, coal, rags, &c., which may find their way into the pump, and so enables it to deal with sewage sludge and other substances of a similar character without risk of blockage. It is driven by a gas engine of 16 b.h.p., and deposits on to the sludge lagoons. The liquid draining from the lagoon sludge is gravitated on to a special area prepared for the purpose. Prior to the sludge being valved off from the tanks the supernatant water is decanted by means of floating arms and treated on the land. The gas for the engine is supplied from our town's main. The engine-house is not quite completed yet, owing to the late starting of the work. This work is being carried out by Mr. Mark Senior, contractor of this town. The pump is being made by the Pulsometer Engineering Company, Reading.

SPRING END INSTALLATION.

The installation scheme is a complete sewage scheme in itself, comprising detritus pit, continuous flow settling tanks in duplicate, 17 ft. by 6 ft., and automatic dose valve to regulate the dosing of the filter. The percolating filter is constructed on exactly the same principle as the large filters, with the exception that it is only 3 ft. 9 in. in depth, and is 20 ft. in diameter, and the filtered effluent discharges direct into the stream.

Many costly schemes to solve the difficulty of dealing with the Spring End outfall have been tried from time to time by experts, who failed to see that it could be worked by gravitation.

The total of the loans granted by the Local Government Board for the whole of these works amount to £11,839, and out of this amount £10,934 has already been spent.

The whole of the works, with the exception of the engine-house, have been carried out by direct labour, without friction and without mishap, under the careful supervision of Mr. D. C. Thwaites, to whom great credit is due for the care he has exercised and the capable and workmanlike manner in which he has performed his duties.

CONCLUSION.

The new works have been designed on as simple lines as possible, having regard to due efficiency, soundness and economy of cost, and were only carried out under extreme pressure by the Local Government Board and the West Riding Rivers Board, and it is fully anticipated that the borough will be provided at the eastern outfall with an efficient sewage disposal works, sufficient to meet all requirements for many years to come.

The Unused Public Subways.—"Great expense is incurred in providing subways and refuges, but the public will not use them," said Dr. Waldo, the City coroner, at an inquest recently on an old lady who was knocked down by a motor-car close to a subway.

Saved by Sanitation.—Sir J. Crichton-Browne, delivering his presidential address at the annual meeting of the Sanitary Inspectors' Association, said that when the history of the present war came to be written its moral would probably be that this country had been saved by sanitation.

Greenock Electricity Department.—Mr. Frank H. Whysall, electrical engineer of Greenock Corporation, has issued the annual report on the working of his department. The total income for the year was £62,705, as compared with £51,538 in the year preceding; and the gross profit was £32,117, or 10·2 per cent on the average capital during the year. After deducting interest, sinking fund, depreciation, &c., the nett surplus on the year's working was £10,397, which is 3·3 per cent on the average capital. The capital account shows that during the year there had been an expenditure in Greenock of £19,054 and in Port-Glasgow of £14,126. This account now stands at £330,109; of this amount £72,709 has been repaid out of revenue account, and the reserve fund at the end of the financial year was £16,635.

SEWAGE DISPOSAL AT BINGLEY.

NEW WORKS.

The sewage works for the Bingley district at Dowley Gap were formally reopened on Saturday by Mr. W. R. Nunns, the chairman of the Sanitary Committee of the Bingley, Yorks, Urban District Council. The previous works were laid down in the years 1900 to 1902, at a cost of £20,667, septic tanks, bacteria beds and land filtration being provided for the treatment of the sewage. For some years the works answered their purpose satisfactorily, but in consequence of subsidence, which caused some of the apparatus to become ineffective, a change in the character of the sewage, which rendered its treatment more difficult on existing lines, and for some other reasons, grounds for complaint arose.

In 1910 the West Riding Rivers Board began to press the council for improved treatment, and Mr. Garfield, the Bradford City Council's engineer, was called in to make a report and advise upon changes in the works. His scheme, however, was not accepted by the council, and the next step was to open negotiations with the Bradford Corporation on the point of conveying the Bingley sewage away from the district and treating it at the Bradford works at Esholt. This suggestion caused some controversy at the time, but in the end the Bingley Council came to the conclusion that it was possible to make the necessary alterations at Dowley Gap and turn out an effluent which would be satisfactory to the Rivers Board at a less cost to the district than was meant by the final offer of the Bradford Corporation. Therefore, in October, 1911, Mr. H. Bottomley, the council's surveyor, was instructed to carry out a scheme which he had drawn up.

The works have been constructed by Messrs. Ward & Tetley, contractors, Bradford, and are now treating satisfactorily a daily dry-weather flow of sewage of 750,000 gallons, and are capable of dealing with three times this amount in wet weather. The works now comprise grit chambers, screening chamber, storm-water tanks and detritus tanks, for the earlier treatment of the sewage, after which it passes through precipitation tanks, percolating filters—of which there are eight—and humus tanks. The precipitating agents employed are lime and alumina ferric, and the necessary machinery has been installed for dealing with this part of the work, together with an office and a laboratory. For the cost of reconstruction the Local Government Board sanctioned a loan of £10,817, and it is stated that this amount has not been exceeded.

Altogether, from the beginning, the *Yorkshire Observer* states, the Bingley Council have spent a sum of £37,556 on sewage work, and the present debt on this account amounts to £26,711. It is calculated that, allowing for the payment of interest and sinking fund instalments, and including all working expenses, the annual charge on the rates will amount to a fraction under 10d. in the £.

Business Announcement.—Messrs. Tuke & Bell inform us that, largely in connection with the development of their work as water specialists in filtration and softening, they have been obliged to take extensive additional premises at Lawrence-road, Seven Sisters, about a mile from their existing works. These premises consist of one large block 120 ft. by 80 ft. by 60 ft. high, with additional forge accommodation adjoining. The firm's office will remain as before at the Carlton Engineering Works, High-road, Tottenham, to which all communications should be addressed.

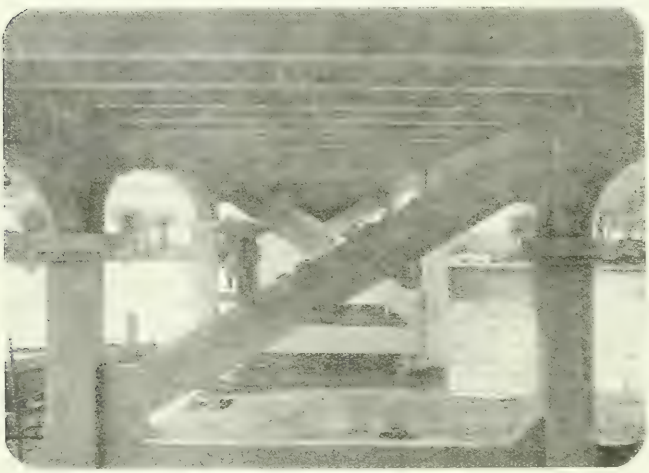
Haulage Difficulties.—The surveyor to the Strood Rural District Council, Mr. L. Randerson, reported recently upon the difficulties he was experiencing in the making and repair of roads. Either the material was not at hand or the haulage was at fault. Demurrage charges were being incurred and rolling delayed. The result would be that the cost per yard for making the roads would be very heavy. Mr. Champion said it seemed that the only remedy was for the council to have their own haulage plant to do their own work. Until they got that the only thing to do was to still go muddling on. Personally, he was sorry the council did not decide, when recently considering the matter, to tackle the question of doing their own haulage straight away. The chairman ruled that the council could not again discuss the provision of their own plant for a period of six months, it having been dealt with recently.

BOW BRIDGE, WATERINGBURY.

Situated in one of the most picturesque districts in the county of Kent, the village of Wateringbury is not (says Mr. Rowland H. Halls, M.S.E., in *Ferro-Concrete*), a place of any particular importance, but the new bridge recently completed in the parish is a valuable link between two parts of the county separated by the river Medway. The two sides of the river in a district which ranks high in agricultural importance, and possesses a considerable population, are once more linked up, and the new bridge, being both more convenient and more commodious for traffic than the old one, may confidently be expected to enhance local prosperity.

Although a timber bridge existed on the site for many years, this structure had become so weather-worn as to be unsafe for modern traffic and dangerous for general use. Moreover, it was extremely inconveniently planned, and constituted an obstacle to navigation on the Medway.

The new bridge, which is built entirely of Mouchel-Hennebique ferro-concrete, was opened in July this year, having been constructed for the Maidstone Rural District Council, who received financial assistance from the Rochester Bridge Wardens, the Road Board, the South Eastern Railway Company,



Under side of Bow Bridge.

and the Medway Navigation Company. The aid willingly rendered by these bodies is sufficient to indicate the important nature of the project, which forms part of a great scheme formulated with the object of preventing a portion of the Medway from becoming derelict.

The new bridge has a total length of 296 ft. from end to end, a width between parapets of 18 ft., and a footway on the east side 3 ft. wide. It includes nine spans, each of the river arches having a span of 28 ft. 6 in., the centre arch being 18 ft. high at the centre, measured from the underside to the river bed. The piers are of the trestle type, supported by ten pairs of ferro-concrete piles each 16 in. square, and driven down through the bed of the river until the firm dark clay is reached.

An important part of the project was a much-needed improvement of the approach roads. The southern approach road is of much easier gradient than the old one, and several feet higher over the river, thus making it better for crossing in flood time. The riverway is also much improved and enlarged, and has made through navigation once more practicable.

The bridge was constructed from plans prepared by Mr. Halls, and the contractors were the Yorkshire Hennebique Contracting Company, Limited, of Leeds. Working drawings of the ferro-concrete work were furnished by Messrs. L. G. Mouchel & Partners, Limited, of Westminster.

The Royal Institute of British Architects has decided to cancel its programme of meetings and sessional papers.

CAIRO SEWERAGE SYSTEM.

Owing to the situation of the city it was difficult to lay out a system of sewerage for Cairo in the ordinary way, with gravity discharge; accordingly, in planning the new sewerage system for the city, which has been recently put in operation, the city has been divided into small areas, and the sewage from each of these areas, after flowing by gravity to a central sump, is forced by compressed air through closed pipes leading to a main outfall sewer.

A brief description of the Cairo system was given by Dr. E. L. Corthell in a paper published in "Professional Memoirs," Corps of Engineers, for May-June, 1915, following his visit to Cairo while the works were under construction. From this and from additional information furnished to Mr. Corthell recently by C. Carkeet James, M.Inst.C.E., under whose direction the works were constructed, the following description has been prepared by *Engineering News*.

The total area in Cairo to be drained with the aid of compressed air is a strip 3 to 4 km. broad, extending along the Nile for nearly 12 km. This tract has been divided into sixty-three small areas. In each of these the sewage flows by gravity to an underground compressed-air discharging station. From each of the stations the sewage is forced by compressed air through closed cast-iron pipes into a gravity outfall conduit, 1·6 m. in diameter, which starts at Pont Ghamra.

In the main outfall sewer the sewage flows by gravity to a pumping station at Kafr-el-Gamus, a distance of 13½ km., receiving the discharge from various suburban gravity sewerage systems on the way. At the pumping station the sewage is screened and then forced by plunger pumping engines through a cast-iron delivery main, 0·92 m. diameter, to a sewage farm at Gebel-el-Asfar, a further distance of 11½ km.

The sewage farm on which the sewage will be used for irrigation is a tract in the desert about 4 km. square. The sewage delivered from the force main will pass through sedimentation tanks, and a portion of it may be further purified on gravel filter-beds. It is expected that about 3,000 feddans of land (3,300 acres) will eventually be irrigated by sewage. About 350 feddans have been graded to receive irrigation water, and 170 feddans have been planted with 35,000 fruit trees, while 80 feddans of cereals are under cultivation. About 80 km. of compressed-air mains and sewage force mains from the compressed-air stations have been laid. Only a small part of the gravity sewers discharging to the compressed-air stations, however, has as yet been constructed. The area around the principal hotels and that near the military barracks, as well as some of the important suburbs, have been sewered. Further work on the laying of sewers was interrupted by the outbreak of war.

The expenditure on the works thus far completed under Mr. James' direction is about E£1,500,000. Approximately E£500,000 more will be required for laying the small sewers to the compressed-air discharge stations.

The system has been planned for the needs of a population of about 1,000,000.

Standards of Sewage Effluents.—The Pontypool Urban District Council have referred to the Streets and Sanitary Committee a letter received from the Panteg Urban District Council asking the council to appoint representatives to attend a conference with a view to pressure being placed on the Local Government Board to enforce by legislation the standards of effluent for sewage disposal schemes, as recommended by the Royal Commissions.

Institution of Municipal and County Engineers.

NORTH-EASTERN DISTRICT MEETING AT BRIGHOUSE.

(*Conclusion.*)

[illegible]

THE DUTIES OF A MUNICIPAL ENGINEER IN THE PRESENT WAR.

[illegible] all indebted to Mr. Haywood for the trouble he had [illegible] description that had accumulated during the more strenuous period before the war. He thought that [illegible] quired should be undertaken, and this might even [illegible] poned by reason of the war, and more particularly [illegible] Having regard to the enormous total indebtedness of the country for war purposes, it seemed impossible to believe that anything approaching the previous conditions of local government expenditure could prevail at the conclusion of the war. Vast sums must be provided annually for interest and sinking fund on war loans, and it might be anticipated that sanction to local authorities would be granted only in respect of schemes of the very utmost urgency. [illegible] large schemes of improvement in every municipality would be held up indefinitely. It appeared therefore desirable to consider methods of economy, not merely [illegible] He [illegible] that old materials which had a marketable value should be converted into money, and in particular he recommended the sale of scrap metals of every description. Quite apart from the present high prices obtained in the metal market, it was highly desirable that no such material, of which munition work absorbed much, should be withheld from the country. Perhaps an exception to the old materials available for sale might be made of old setts. Reference had been made in the paper to granite paving in Brighouse held over in consequence of the war. Similar conditions had prevailed in Wakefield; but, having a quantity of old setts in stock, he had been able to relay roadways this summer the cost of which otherwise would have been quite prohibitive. Old granite commanded a ready sale at fair prices, but a more real economy would be shown in retaining this for repairs. Old York laid crossings might be renewed with granite setts. Referring to the necessity of increasing the national food supply, he said for this reason the provision of allotment gardens might be considered where none existed and land was available. In Wakefield they had something like 11 acres of allotments, and the demand exceeded the supply. The difficulty was, of course, of acquiring suitable land, with proper water supply, and not costing too much money. He had pleasure in proposing a vote of thanks to Mr. Haywood for his paper.

Mr. A. Rothera (Spenborough) seconded the vote of thanks to Mr. Haywood for his interesting paper. He thought Mr. Haywood must have spent a good deal of time in collating the different heads under which he had written the paper, and he had given them a good many points on which they might exercise their thoughts to bring about economies. One of the most remarkable things in the paper was the third paragraph, which demanded a self-examination by every member to see if he could not at this great national crisis help on the great work which they wanted to see accomplished—the complete breaking of the Huns for ever. The example which had been set by their hon. district secretary (Mr. Kirby) was one which might be followed by some in that room, and he recommended it for their thought in the future. Mr. Haywood passed on, in a very desirable way, from head officials down to assistants, and pointed out how in different ways he thought they might be able to help on the work he had referred to in the early part of his paper. Dealing with the question of the introduction of ladies into municipal offices to help in the work, he thought, particularly at the present time, it was a very desirable one, particularly in a large office, where the work was more of a departmental character. But in an office of the size of his own he did not think the lady "would come to stay," because they wanted more the handyman, who would be able to take up all sorts of jobs. So far as the small authorities went, he did not think a lady would be suitable. With regard to economy in the drawing office, he hardly agreed with Mr. Haywood there, because cheap drawing materials were only time-wasters and aids to developing the [illegible] believed the true note to be to have the best officials and materials and economy with efficiency. Regarding the outdoor work, in some towns there were too many passengers; but in his own town, apart from sentiment for old labourers, he did not see how there could be any cutting down. During the last [illegible] attitude with regard to the work brought to their notice, [illegible] not carry out instructions. In most cases those men had left. He did not think it would be an economy to do away with street watering, and as it conduced to the public health it should not be cut down. Mr. Haywood mentioned the sale of street manure and sweepings. He was very lucky to have a market for that. For several years he had tried to get a market for it and failed. In the destructor department he thought all of them could point to a need for economy in the collection of refuse. They would all have noticed the large quantities of waste paper which [illegible] fair amount of money. Just recently he had had to report on the reduction of street lighting in the new borough of Spenborough. Of 1,000 lamps in the borough they were doing without 600 for the rest of the season to March 31st. Another thing which the chief might do in the way of economy was to give a little more supervision of road repairs. If he would only give a day now and then to this it was astonishing how the work could be got on with. Then their councils might have a hint given to them to have less meetings, when there would be less stamps and stationery, and also more time for the officials to devote their energies to the various other channels mentioned by Mr. Haywood. With regard to their position towards the military authorities, he had been very willing to do what he could to help them in various small ways; but it seemed to him, and it was the experience of other surveyors, that if the military wanted surveyors to help them more than they did they must drop their domineering manner. A friend of his, who was in a district where there were thousands of men, was fairly disgusted with the young officers.

Mr. W. J. Steele (Newcastle-on-Tyne) thought Mr. Haywood was to be congratulated on giving them a distinctive subject for discussion, instead of a description of the municipal works in Brighouse. Mr. Rothera was rather hopeful of the public. This war, if it had taught them anything at all, had taught them the absolute necessity for discipline in this country. To show what little effect a request would have, he might say that some two years ago he sent out to something like 40,000 householders in Newcastle a circular asking them to burn the whole of their garbage and waste paper, so as to relieve the cleansing staff. He thought the only effect of that circular was to increase the quantity of garbage and of paper; so he thought if they were going to expect the public to do things they would be disappointed; they would not do it unless they were compelled. That had been his sad experience, not only in that respect, but in several others. The first question [illegible] What is the first duty of a man? The first duty of a man was to join the Army if he could. It was not given to all of them to join the Army—some because of age, some because their councils would not let them go, and some because of other ties; but if a man could go, whether a head official or an assistant, there could be no question about his duty. The members of that institution had done remarkably well. He expected

his experience was that of every man in the room. One-third of the indoor staff had joined the Army, and one-fourth of the outdoor staff had joined the Army or gone into munition factories. Personally, he found he had a great deal more to do, not only in carrying out work, but in organisation. He went much further than Mr. Haywood in the employment of women. They had about 110 women on street cleaning and about fifteen women in the parks, and the result of their labour had been excellent. They were paid 6d. per hour, against the 6¾d. per hour paid to men, and they did not get any war bonus. They worked thirty-eight hours per week. They had absorbed all the casual male labour, and had fallen back upon the women, and it had been extremely successful. The experiment had been even more successful in the case of the tramway system. There were about 157 women tram conductors, and but for the help of these girls, and the voluntary workers, they would have had difficulty in maintaining properly the service. Some 350 of their tramway staff had gone into the Army. Instead of the demand for cars being less, it was greater than it had ever been in its history, largely from the difficulty of getting men to and from the munition factories. If a man could not go into the Army he had only to look round, and he would not have to look far before he found there was something to do. With regard to economies, a lot of their councillors were expecting, with all this depletion of staff and stoppage of work, they were going to have enormous savings in the rates. But this reduction of expenditure was discounted in this way—practically every council was giving a war bonus, and every council was paying considerable allowances to the dependants of men who had gone into the Army, in addition to having to employ more or less efficient casual labour to carry on the work. So they were not going to have the big economies that many councillors expected. There would be a reduction, but nothing like what some of the councillors were hoping for. It was very difficult to discuss a question of this kind without being personal. If a man could not do anything in the way of making shells or helping the military authorities, he certainly could join the Volunteer Training Corps. He had had the privilege of being a member of the Volunteer Corps since August of last year, and 700 men had gone into the Army from that corps. They had formed an Engineering Company, and not only built bridges, but had dug trenches by day and night. He was surprised to find how little he knew of how to handle a pick. He endorsed fully what Mr. Haywood had said, that the first duty of a man, if at all possible, was to join the Army.

Mr. C. F. Wike (Sheffield) thought if statistics were examined that municipal people had supplied as big a percentage as any other class in the country. There were many chief surveyors who were now serving the King. One municipal officer, who was on his own staff for some time, Mr. Gilbert Hart, of Manchester, had received the Distinguished Service Order. There might be others, but Mr. Hart he knew personally. With regard to economy, he thought they might all take it for granted that the Local Government Board would decide that they should be economical. To a certain extent he agreed with that, as it was not only money, but the nation needed men, so that those men could be sent to the munition works or to the front. Of course, there were anomalies in the methods of economy. He would give them two instances which had occurred to himself. The Local Government Board some time back were pressing the Sheffield Corporation to extend the sewage works. They were not very desirous of doing so, because they did not think it necessary; however, pressure was put upon them to do so. In the early days of the war there was a fear that there would be a good deal of surplus labour, and they were pressed by the Government to go on with the work. There was scarcely time to get the plans out, and the Local Government Board said they might proceed with sketch plans; but now they said they would not let the corporation do the work, but they must wait until the war was over. There was another case of a bridge in Sheffield. They borrowed money for the rebuilding of a bridge which belonged to a company, which was finding part of the money for the work. Now the Local Government Board would not let them spend the money and go on with the work, though the bridge was considered to be unsafe. There was another point with regard to war bonuses and the increase in the cost of living. The working classes had got their war bonuses, and they had also had their wages raised. He thought if anybody deserved a war bonus, or an increase of salary, it was the underpaid smaller officials, the clerks and those who did not get very big salaries. Many of them had their guilds. They had in the bigger towns. He heard a labour man say the other day that if they had not obtained an increase of salary or a war bonus it was the fault of their guilds.

Mr. Morris (Doncaster) suggested that the preparation of town planning might be included in the work under preparation for the period after the war.

Mr. W. Fowlds (Keighley) described the paper as one which appealed to all of them. One of the points in his mind was that the councils might have done more for the assistants who had gone on active service. Three of his assistants had gone; one had got a commission, and one was in the ambulance section. His council had given to every married man who had gone a minimum allowance of 5s. per week. One of their labourers who had gone was earning 22s. or 23s. a week. He was a married man with four or five children, and his wife, with the separation allowance and the 5s. from the corporation, was better off than before. He had not a word to say against the separation allowance, and, of course, a wife missed her husband, but she was better off because she had the Government allowance and the 5s., and she had not her husband to keep. Apply that to the assistants. He had an assistant at £130 a year. What did the council offer him? They offered him half-a-crown a week. He had no one actually dependent on him, and as a private he would get 7s. a week. That man felt he was not only leaving a good salary and a good home, but nothing was being done for him. They made the workman better off than he was before. He thought something should have been done for the better class of assistants to tempt them to go and make it easier for them financially. He wondered what the opinion of the members was about after the war. They all hoped there would be an after the war. He had had this brought home to him. He had called upon the Local Government Board about a big scheme, which might cost £100,000, and they said, "Get your plans ready, so that you will have some work when the war is over, and there will be a good deal of unemployment and distress." That seemed all right, and he started the staff on it, intending to push on the plans; but as the war went on, and the financial question became so acute, he began to think that taxes might be so high that many of these schemes would not be proceeded with. It was no good working hard at these schemes and keeping a staff on them if after the war there was no prospect that they would be allowed to go on.

Mr. C. Vawser (Ripon) thought Mr. Haywood might be congratulated upon writing a paper upon what might be called unorthodox lines. Mr. Haywood said their work was not of the strenuous character of the pre-war period. His experience, being situate near to a military camp, was that there was more strenuous work. With regard to economies, or so-called economies, with the pre-war period, he agreed with Mr. Haywood that they should employ female labour wherever possible. At the present time the country was being bled of the flower of its manhood, and it was quite possible that many of those who returned would not be as efficient as when they went away. As to the questions, "What do I want?" and "What can I do without?" those were questions which might either be regarded as personal or addressed to them as officials. If as officials, they might ask, What did they want for the benefit of their district, and what work could be deferred for the time being? There were many things which they wanted, and which they knew would be an improvement and a benefit to their respective areas; yet there might not be any great urgency, and they could be deferred. As to their drawing offices, he thought it was economy to have the best materials there; but they could undoubtedly do without the foreign-made articles. There was a chance there by which they could encourage home industries, and avoid the sending of money out of the country. Mr. Haywood said they must weed out their less capable and industrious men. Well, the most capable and industrious had joined the service of the State, either in the Army or munition works, and the municipalities were left with the least capable and the class of men who frequently lounged at public-house corners. Then they were told that in highway work the restrictions placed on expenditure by the Local Government Board had upset many of

that point, and that this had been a great mistake. Well, in his opinion it would be more or less of a waste of the Local Government Board did continue to permit loans for road and railway work, because there had been a great amount of traffic taken from the railways on to the highways, and consequently a great many roads were in need of reconstruction. Then with regard to remuneration, Mr. Haywood said their remuneration remained stationary. That, he believed, was unfortunately the case. In many places public authorities were advertising for [illegible] which perhaps were reasonable in pre-war days, but were unreasonable to-day. He was looking an appointment at [illegible] never [illegible] the salary in practice was less than his actual out-of-pocket expenses per month. Owing to the peculiar circumstances in which he was situated his monthly salary did not equal the cost of his living. The workmen had had their salaries increased by 20 per cent, and some by as much as 30 per cent. But these increases did not come to the chief official under the authority, who had not only [illegible] to keep up, but was [illegible] to put a considerable sum in learning his profession.

The vote of thanks having been [illegible] passed,

Mr. Haywood, in reply, first thanked the members for the way in which they had discussed the paper. He was agreeably surprised to find it was open to such discussion. But they had not touched enough upon the Volunteer movement; that was the point he had at heart. Mr. Steele had said he was a brother in the movement. Unfortunately, he was a month later than Mr. Steele in joining; he joined in September, 1914. [illegible] were getting 15s. per ton. That was taken away from the depot by the Bradford Corporation, who sent a closed motor van for it, and they were very anxious to get it. For their old tins 7s. 6d. per ton was obtained. They got 18s. per ton for old glass; 3d. per dozen for jam jars; and 2s. per ton for riddled ashes. The old highway brushes were sold for 4d. each for domestic use. The chairman must not understand from their selling old materials that he suggested the selling of setts. With regard to allowances to men who enlisted, single men got 7s. per week, so that did not make up their salaries to the previous figure; and married men, if they were not getting as much as they previously earned, had their salaries made up. The master of one of their council schools who had £180 or £200 a year, had his salaries made up. The chief sanitary inspector was also having his salary made up. They had had so many men enlisted from the corporation that a resolution was passed on the previous Wednesday night that no more workmen were to enlist without the consent of a small sub-committee. Brighouse had done its duty. Brighouse was third in the list of all England for having provided men for the Army in one branch or the other.

Cost of Artificial Stone.—We understand that the artificial stone manufacturers have found it necessary owing to the increased cost of cement and other materials, freight haulage &c., to give notice of an increase in price of from 1d. to 6d. per yard super.

Street Lighting in Stockport. In his annual report, Mr. John Atkinson, Assoc.M.Inst.C.E., the borough surveyor mentions that there are 3 232 lamps erected and kept lighted within the boundaries of the former borough of Stockport, forty-seven having been added this year. As 85 miles of public highways and about 15 miles of private streets and roads are provided for, the average distance apart is about 5½ yds. Within recent years, however, the lamps have been placed at an average distance of 40 yds.

Municipal v. Private Trading. On Wednesday the House of Commons went into Committee on the Finance Bill, and Clause 35, which deals with the trades and business to which the excess profits duty is to apply, was considered. Mr. Lough moved to exempt from the tax any enterprise in the nature of a trade or business carried on by municipal authorities. Mr. Anderson (Lab., Sheffield, Attercliffe) supported the amendment. Mr. McKenna said he could not accept the amendment. The profits of municipal authorities were already subjected to income tax, and municipal undertakings were often in competition with private businesses, and Parliament had decided that these undertakings should be placed on an equal footing in regard to taxation. The amendment was negatived without a division.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Should not the formation of the "Royal Garrison Artillery Siege Batteries," of which particulars appeared in last week's Surveyor, appeal strongly to young surveyors and engineers who are unable to get work owing to the war? As the pay is high, and the duties of an exceptionally interesting description, should not this attract a large number of young men who are desirous of "doing something for their country" at this critical stage?

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Was not Mr. S. S. Haywood, the borough engineer of Brighouse, to be heartily congratulated on the excellent paper on the duties of a municipal engineer in the present war, which he read at the recent North-Eastern District meeting of the Institution of Municipal and County Engineers? Was it not just the kind of paper that is wanted at the present moment, and could not the council of the institution direct that it should be printed in pamphlet form and distributed broadcast to all municipal engineers and surveyors throughout the land? Would not such an action tend to remove the impression that "the institution" has been sadly lacking in initiative during the present crisis?

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Apropos of the above, is it not to be regretted that a resolution was passed at the same meeting excluding the Press from all future meetings in this district? Was not the reason for this decision—that younger members would feel less shy and be able to talk if reporters were not present—rather a lame one, for would it not surely be better to train men to put their thoughts into words and to make a consecutive statement, rather than allow them to get into a habit of desultory talk at a "round table," as one of the advocates of exclusion expressed it? Of what use is a hole-and-corner meeting of a few men towards the advancement of professional knowledge as a whole? Has not the council of the institution some power over the districts as to how they conduct their meetings?

• • • •

What a "fever matter" is one of the things one would certainly like to know. Who is Mr. Glass, who, at a meeting of the Worsley Urban District Council, is reported to have said that the trade waste from the process of bleaching "had a distinct advantage to the sewage, as it had a disinfecting effect on the fever matter"? Is it possible that Mr. Glass, to use a Biblical expression, now sees things darkly?

• • • •

Is it not satisfactory to learn that the presence of B. coli in water in large open reservoirs is not always a symptom, or sign, of sewage contamination, but is due to seagulls? Would it not be well if Prof. Beattie, the bacteriologist to the Liverpool Corporation Water Committee, who made this statement, could amplify this discovery by stating whether the presence of B. coli was due to the excreta of these birds or to any foul matter that might have adhered to their feet and legs when feeding on heavily manured land or on garbage along the shore which might contain sewage? Would there not be one risk of dangerous pollution of the water if B. coli were due to the latter cause?

• • • •

Is not the recent inquiry of the Local Government Board of Scotland at Glasgow rather unusual when we find it is an inquiry into the increases of rental of small dwellings in industrial districts in Scotland? Have we any similar powers in England, and in what direction can the result of such an inquiry be decided? Can owners of property be compelled to reduce their rents, or can private enterprise be forced? Is it not clear from the evidence laid before the commissioners that further accommodation is urgently required in the Clyde Valley, where the influx of workmen, attracted by high wages, has been so enormous?

• • • •

Does not the miserable attempt by certain members of the Bristol Corporation to terminate the agreement with the late city engineer—whereby he was appointed consulting engineer—remind one of Æsop's Fable, the Dying Lion being Kicked by a Jackass? Does the episode not also show the crying need for a proper superannuation of surveyors, who at the present time have to look to the "gratitude" of their employers to make provision for them when they retire? How long will such a scandalous state of things be allowed to continue?

CORRESPONDENCE.

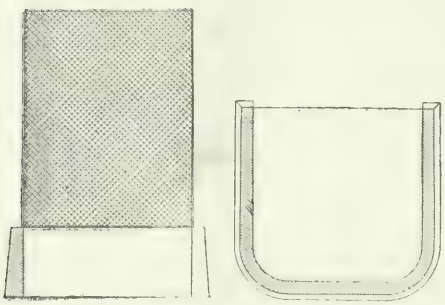
Εις ἀνηρ οὐ πανθ' ὁρᾶ
(One man does not see everything.)
— Euripides.

DESTRUCTION OF CAMP REFUSE.

To the Editor of The Surveyor.

Sir,—I am again indebted to Mr. S. Clifford Rigg for materials from which the following is prepared:

Fig. 1 shows the method of storage of refuse, pending destruction in the incinerator. The curb consists of a dummy wall about 2 ft. in height, surmounted

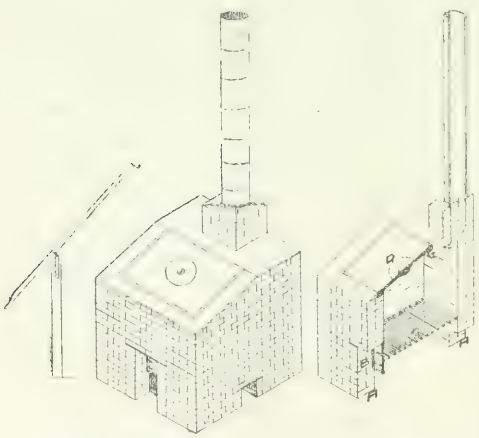


Section through curb. Plan.

Fig. 1.

by wire netting, and the whole in appearance like a large fireguard.

Fig. 2 shows a new type of destructor, with which no difficulty is found in burning wet or dry refuse; fæcal matter is cremated equally well. The bricks used in the construction are taken from ruined buildings, the mortar consists of wetted clay and



A. Draught holes. C. Grid clinker.
B. Raking hole. D. Feeding hol.

Fig. 2.

short straw, well mixed. The chimney consists of empty drums (with bottom knocked out) fitted one on another.

My informant draws special attention to the contrivance (shown on left of sketch) for removing lid.—Yours, &c.,

G. Bertram Harterre.

Town Hall,
Alton, Hants.
October 26, 1915.

PROTECTION OF SEA OUTFALLS.

To the Editor of The Surveyor.

Sir,—In reply to "Fabius" with reference to his sewers outfall pipe becoming endangered by the action of the sea, it is rather dangerous to give advice upon a matter without seeing the *locus in quo*, but I should say that to stack cobbles round the piles to support them would only aggravate the sea and cause a scour, exposing the piles still more. A system of groynes put in at the proper angle would be far more advantageous; this would collect the sand and beach, and in time would protect the piles and outfall.

If the wooden piles are getting too weak for the support of the pipes, I should replace them by reinforced-concrete piles, which would last for many years and are not affected by worms in the way that wooden piles are. They are easily made, and could be undertaken locally without any outside assistance.

Yours, &c.,

Oswald A. Bridges,
Engineer and Surveyor.

Council Offices,
Bognor.
October 29, 1915.

LUMINOUS PAINT.

To the Editor of The Surveyor.

Sir,—With reference to the paragraph of inquiry on p. 461 of your current issue, I am now experimenting on a few lamp-posts with this material, and have been able to obtain samples from Messrs. H. W. Cox & Co., 159 Great Portland-street, London, W., at 7s. per lb.; and from Messrs. W. C. Horne, St. Katherines, London-road, North Cheam, Surrey, at 12s. per lb.—Yours, &c.,

H. Gilbert Whyatt,
Borough Engineer and Surveyor.

Grimsby,
October 29, 1915.

To the Editor of The Surveyor.

Sir,—In reply to the inquiry in the current issue of The Surveyor as to luminous paint, this material is made by Messrs. Griffiths, Brothers & Co., paint, &c., specialists, Bermondsey, S.E. It is about 12s. per lb. One pound covers a square yard, three coats thick.—Yours, &c.,

Arthur E. Collins,
City Engineer.

Norwich.
November 1, 1915.

Lower Thames Valley District Surveyors' Association.—At a meeting of this body to be held at Twickenham Town Hall to-morrow (Saturday), Mr. E. Willi engineer and surveyor to the Chiswick Urban D. trict Council, will read a paper entitled "Economy in Wartime."

Aberdeen Water Bill. The Parliamentary inquiry into the Aberdeen Corporation Water Bill has been concluded. The commissioners unanimously found the preamble of the Bill proved, subject to the adjustment of clauses. The commissioners did not think it necessary to insert any provision as to compensation water.

A Cow's Fatal Thirst.—At their meeting on Monday the Sleaford Rural District Council had before them a claim of £25 for the loss of a cow which the owner alleged was killed through consuming weed killer by the side of a road. The council decided to pay the claim and to prohibit the use of the weed killer on the roads for the future.

Waterproofing of Basements.—The architect for the Haslington Council school reports that the excavations were made in running water. The concrete floors and walls of the basements were treated with waterproofed cement. We understand the use of the powder Pudlo has proved a great success, and effectively prevented any flooding of the cellars.

Road Board Finance.—In the House of Commons on Tuesday the Secretary of the Treasury was asked what was the amount of money received by the Road Board since it was established; the sum expended by that body in the improvement of the roads; and what was the balance now in the hands of the board. The Financial Secretary to the Treasury (Mr. Montagu) stated that the total receipts of the Road Board up to September 30, 1915, including interest on investments, amounted to £7,176,059. The total grants actually made to highway authorities up to the end of last month amounted to £2,410,978. Advances by way of loan had been made up to a total of £932,259, of which £201,682 had been repaid. The balance in the hands of the board on September 30th amounted to £3,966,065, including £3,924,742 investments at cost.

The Surveyor
And Municipal and County Engineer

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WATER SUPPLY IN THE SLEAFORD RURAL DISTRICT.

NEW WORKS FOR FOUR PARISHES.

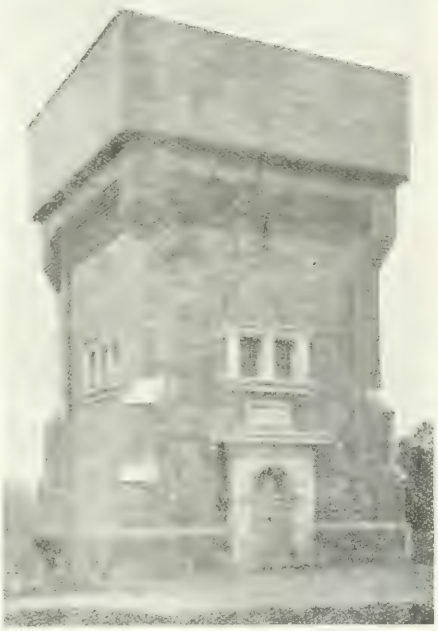
The inauguration took place recently of new works for water supply which have been provided by the Sleaford, Lincs, Rural District Council for the parishes of Ewerby, Evedon, Haverholme Priory, and Kirkby Laythorpe. The council's old supply for part of this district was from the river Slea, at a point near Haverholme Lock, which provided, by means of a turbine, unfiltered water to the parishes of Ewerby, Haverholme and Anwick, each parish having separate tanks and small filters. Anwick parish is now supplied from a borehole in their own parish, and have now a separate waterworks of their own. Owing to the polluted state of the river, it was decided that the parishes of Ewerby and Haverholme, together with those of Evedon and Kirkby Laythorpe, should be supplied from a new borehole, sunk at Evedon Hill, 195 ft. below ground level and into the Lincolnshire oolite, with a 12-ft. sump below maximum water-bearing strata. The boring was lined with steel tubes, and the average yield of water from the borehole is 72,000 gallons per day.

The new works of supply are situated directly over the borehole at Evedon Hill, and comprise a brick tower faced with Lincoln red pressed brick and Ancester stone dressings, 36 ft. high, with cast-iron tank, 25 ft. square by 8 ft. 6 in. high on the top of the tower, and designed to hold 31,250 gallons, with a minimum head of water above the highest road level of 42 ft., thus securing a constant supply to the highest level of any building in the district. The tank, which has been cast by Messrs. Newton Chambers, ironfounders, of Thorncliffe, Sheffield, is composed of 4-ft. square plates. Careful measures have been taken to avoid as much as possible any condensation by the atmosphere on the underside of the tank.

The machinery, which is of the very latest design, is by Messrs. R. Hornsby & Sons, Grantham, whose pumping machinery is now practically adopted throughout the council's district, and has been designed to lift, 60 ft. high, 3,600 gallons of water per hour.

The old water mains running across Haverholme Park have been reused, after cut-outs had been carefully examined for corrosion, and these mains, together with the village supply main and services, were all disinfected previous to the opening of the works. The difficulty of changing from the old supply to the new water was overcome with a minimum of discomfort to the water consumers. Owing to transport difficulties, the damage done in the delivery of the tank plates and other unavoidable circumstances arising from the war, the construction of the new works was considerably delayed. The contractor's estimate for these works was £2,896, which, together with the cost of the borehole and other incidental charges, will bring the total cost to over £3,100.

The contractor for the whole of the works was Mr. J. T. Barnes, of Sleaford, who has been responsible for the erection of many of the council's other waterworks. The contract for the brick tower was sub-let to Messrs. Maxey & Sons, Sleaford.



EVEDON HILL WATER TOWER.

Mr. W. B. Marsden, the engineer and surveyor to the Sleaford Rural District Council, was the engineer for the scheme.

A Fair Inference. Little girl (to her mother), in reference to elderly gentleman's white spats: "I suppose that old gentleman's awfly afraid of being run over. D'you see, Mummy? He's got his kerbs whitened." *Punch.*

A Unique Survey. -Lieutenant William Harry Tapp, 2nd Dragoon Guards, in order to fix observation points and correct contours on a map of Hill 70, near Loos, took a plane table into the front line and carried out a survey under a continuous fire which his table attracted.

Falmouth.—An illustrated booklet, which has been prepared with the object of providing intending visitors with particulars as to the climate and resources of this charmingly situated Cornish town, has just been issued. Copies, the town clerk, Mr. E. E. Armitage, informs us, will be sent to any of our readers on receipt of a post-card.

Stockport Street Pavings.—The carriageways of Stockport, states Mr. John Atkinson, ASSOC.M.INST.C.E., the borough surveyor, in his annual report, are principally composed of Lancashire and Derbyshire grit setts, with Welsh and Dalbeattie granite setts on the important thoroughfares. On the main roads, however, the grit paving is gradually being done away with, and granite paving, granited rock asphalt and Trinidad asphalt macadam laid down instead. The macadamised roads in the borough are not of great extent.

Road Construction and Maintenance in Johannesburg.*

By G. S. BURT ANDREWS, M.Inst.C.E.

(Conclusion.)

Some years ago a comparison was made of the cost of motor traction and horse-drawn vehicles. Careful observations were taken extending over a period of six weeks, and the results show that animal traction is more economical than motor traction for this class of work. The details of the cost in each case are given in the following tables:

Horse Vans.

		£	s.	d.
First cost	Van with 150-gallon tank ...	75	0	0
	Horses (2)	72	0	0
	Harness	6	0	0
		£153	0	0

	£	s.	d.	£	s.	d.
Interest on £153 at 6 per cent ...	9	3	7			
Depreciation of van, 10 per cent ...	7	10	0			
Depreciation of harness, 50 per cent	3	0	0			
Renewal of animals, 33⅓ per cent ...	24	0	0			
				£43	13	7

Cost per month (thirty days).

	£	s.	d.
Interest, depreciation, and renewals ...	3	12	10
Repairs to and maintenance of van and harness...	1	5	7
Feeding of animals (two) 27 lb. each per day ...	6	6	10
Water for animals	0	4	2
Shoeing of animals	0	14	0
Stabling, cleaning, and removing rubbish ...	3	13	6½
Attendance on sick horses	0	6	0
Supervision (proportion of one foreman and two overseers)	1	8	6
Sanitary service and lighting	0	4	9
Drivers' wages	9	0	0
Accidents (average cost per van)	1	11	1
Administration charges	0	19	3
	£29	6	6½

The average number of loads per van per month, after making allowance for loss of time occasioned by wet weather, horses being shod, repairs to vans, &c., is 617, which is equal to 277,650 gallons.

Therefore $\frac{£29\ 6s.\ 6\frac{1}{2}d.}{277,650}$ = ·0253 pence per gallon, or 2s. 1·3d. per 1,000 gallons.

Motor Vans.

		£	s.	d.
First cost	Motors with 700-gallon tank ...	950	0	0
	Tarpaulin	3	0	0
		£953	0	0

Cost per month (twenty-six working days).

	£	s.	d.
Interest and depreciation	24	16	2
Repairs and maintenance	14	10	8
Coal, sixty-seven bags per month at 1s. 9d. ...	5	17	3
Wood, twenty-seven bags per month at 4½d. ...	0	10	2
Waste, 17 lb. at 6d.	0	8	6
Cylinder oil, 15¼ gallons at 19s. per 10 gallons ...	1	8	9
Machine oil, 3½ gallons at 15s. per 10 gallons ...	0	4	6
Paraffin, 3 gallons at 11s. 3d. per 10 gallons ...	0	3	4
Antifriction grease, 10 lb. at 8s. 3d. per 56 lb. drum	0	1	8
Stauffer grease, 3 lb. at 5d. per lb. ...	0	1	3
Water, 3,600 gallons per month at 6s. per 1,000 gallons	1	1	8
Sundries	0	4	7
Drivers' wages at 18s. 4d. per day	24	15	0
Insurance against accidents	0	4	8
Administration charges	1	10	0
	£75	18	2

The average number of loads distributed per month was 564, which is equal to 394,800 gallons. Therefore $\frac{£75\ 18s.\ 2d.}{394,800}$ =·0461d. per gallon, or 3s. 10·1d. per 1,000 galls.

The cost of water and upkeep of hydrants and hoses is not included in either case; if added, the result would be

Horse Vans 150 Gallons.

	Per gall. d.	Per 1,000 galls. s.	d.
Cost of distributing water ...	·0253	2	1·3
Cost of water	·072	6	0
Maintenance of hydrants and hoses ...	·00275	0	2·75
	·10005	8	4·05

Motor Van.

Cost of distributing water	·046	3	10·1
Cost of water	·072	6	0
Maintenance of hydrants and hoses ...	·00275	0	2·75
	·12085	10	0·85

Labour. Natives are employed on road construction and maintenance under white overseers. The number working under one overseer depends on the conditions of the labour market, but the ordinary working number is twenty-five when labour is plentiful. Native labour may be considered satisfactory for road work under certain conditions, but good results are seldom obtained unless the overseer understands the native and the native the overseer. In some instances white men who do not know a word of Dutch or Kaffir are successful as overseers, but this is the exception rather than the rule. Native labour is generally scarce during the months of July, August and September. Some years ago the supply had to be kept up by recruiting, but this, fortunately, has not been necessary for some considerable time. A recruited native under contract is a difficult person to deal with. During the year ending June 31, 1915, the largest number employed on road work was 750, and the smallest 500. The ordinary native labourers are paid 1s. 8d. a day.

Contract and Departmental Work. Most of the macadamising of roads has been carried out departmentally, but during the years 1904 to 1909 about 40 miles altogether was done by contract. Some of the contract work gave a lot of trouble, which ended in litigation, and as the cost was never less, and often times more, the work reverted back entirely to the departmental system. It was fairly evident that those who tendered were not well equipped for this class of work, and a good deal of the plant had to be hired or purchased specially for the one job. The cost per square yard by contract varied from 3s. 6d. to 6s. per square yard; the present cost of departmental work is about 2s. 3d.

It is, however, only fair to state that the cost of stone and cartage is less now than it was. In those days stone cost from 2s. to 3s. 2d. per load of 17 cub. ft.; it can now be obtained for 1s. from contractors, and less from the council's crushers.

Stone-breaking Plant.—When the municipal stone-breaking plant was erected in 1910 it consisted of two Blake-Marsden machines, 20 in. by 10 in., driven by two 30-h.p. motors, two rotary screens or trommels, 13 ft. by 2 ft. 9 in., one 10-h.p. motor for driving trommels and conveyor belts, one reduction gear, and bins, with a capacity of 867 cub. ft., so arranged that tramway freight cars and scotch carts can be loaded at the same time. The conveyor belt is 20 in. wide; it is run at a speed of from 290 ft. to 230 ft. per minute and placed at an angle of 20½ deg. The total cost was £4,756, of which £770 was for a tramway siding.

Since then the following alterations and additions have been made: One additional 20-in. by 10-in. machine, 30-h.p. motors replaced by 50-h.p. motors, and 10-h.p. motor replaced by 15-h.p.; speed of screens reduced from 25 to 18 revolutions per minute, new switch-board, and two new granulators and bins.

These additions bring the capital cost up to £6,956.

The progressive average cost since July, 1912, has varied from 10·08d. to 11·56d. per load of 17 cub. ft., all sizes included. This includes 8 per cent on the capital outlay for interest and depreciation, and £42 per month for rent of site and royalty on stone. The average production per hour from two 20-in. by 10-in. crushers is 663 cub. ft. of 2½-in., 102 cub. ft. of 1-in., and 136 cub. ft. of ½-in. and under. The output per month has varied from 6,606 to 11,868 loads of 17 cub. ft. per month, all sizes included. The total quantity of stone broken from July, 1910, to the end of April, 1915, was 587,164 loads, which gives an average of 9,786 loads per month. The maximum number of loads crushed in one day was 594 loads.

Broken stone for road construction and maintenance is also obtained from several contractors at 1s. per load, all sizes included. The total quantity used for the six months ending December 31, 1914, was 90,871 loads, of which 62,846 loads were produced at the municipal stone-breaking plant.

* Third instalment of a paper read at a meeting of the South African Society of Civil Engineers.

Dust Prevention.—One of the great drawbacks to the ordinary macadam road, especially since the advent of motor cars, is the creation of dust in dry weather and mud when it rains. The dust nuisance is particularly noticeable in a very dry place like Johannesburg. Until recent years the most commonly known method of keeping down dust was by means of water distributed in a variety of ways on the roads. Various kinds of distributors have been tried, but on the whole it is considered that the simplest and most economical for our work is the ordinary hose sprinkler. Some of the rotary sprinklers gave good results, but they had to be discarded owing to excessive cost of maintenance. The greatest number of vans in use at one time is thirty-six; of these fourteen have a capacity of 450 gallons, and the balance 350 gallons. During the past year about 75,000,000 gallons have been used for street watering, which cost £16,875 for water alone. Tanks with a capacity of from 350 to 400 gallons are found to be best suited for general work. The 450-gallon tanks are more economical for fairly level roads, but the weight is excessive for two horses where the gradient is more than 1 in 25.

The work done by the vans is from twenty-six to thirty loads per full working day, and the number of square yards of road surface-watered per gallon varies from 5·9 to 6·7.

In America crude oil is very largely used for keeping down dust in public thoroughfares. It is not only applied to macadamised roads, but also to roads formed out of the natural soil. After obtaining much information on the subject the Johannesburg Council agreed, on my recommendation, to obtain a quantity of oil for experimental purposes.

In calling for tenders the following conditions were imposed: (1) That the gravity should be between 13 deg. and 17 deg. Baume's scale; (2) that the oil should contain not less than 40 per cent of bitumen; (3) that it should contain not more than 4 per cent of water.

The cost delivered in Johannesburg was 10·97d. per gallon. The first experiment was made on an unmade road where the formation was red soil. The ground was first picked up, graded, and formed to a camber of 1 in 20. The oil was then heated to about 314 deg. Fahr., and distributed over the surface of the road, about 1 gallon being used to the square yard. The cost, including formation work, was 1s. 10½d. per square yard, and the result was by no means satisfactory. A second experiment was made on an unmade road, where the formation was of a shaly nature. This cost 1s. 2d. per square yard, and gave no better result. The conclusion arrived at was that oil treatment was too expensive, as it was considered that at least 1½ gallons was required per square yard of road to prevent the breaking up of the surface, which would cost about 1s. 11d., exclusive of the formation work.

Many experiments have been made with patent dust-laying compositions, but the result of the trials was not sufficiently satisfactory to justify the use of any one of them on a large scale.

About ten years ago the council authorised a sum of money for the purpose of experimenting with tar for the prevention of dust on roads. A short length of one of the principal thoroughfares was coated with this material, and the result proved to be so satisfactory that it was decided to extend operations in this direction. Since then considerable advance has been made in the tar-coating of roads, and a large sum of money is now voted annually for this particular work. The quantity actually used for the twelve months ending June 30, 1915, was 257,000 gallons. Although the tar-coating of a road appears to be a very simple matter, it has been found that failure easily occurs unless great care is exercised. In the first place the tar should be of approved quality, and contain the right proportions of pitch and oils. It should not be applied to a newly metalled road when ordinary binding is used—about eight weeks is the time usually allowed here—nor until the road is perfectly dry. It should be heated to about 230 deg. Fahr., and applied immediately after removal from the boiler, and then covered with a thin layer of ¼-in. to ½-in. screenings. When the first experiments were made the road, before the tar was applied, was swept lightly by drawing and not pushing the brooms, so as not to remove the binding from the interstices of the metal. Further experiments showed that far better results were obtained by sweeping the road as hard as it was possible without disturbing the metal. The tar is applied by hand sprays or buckets, and this is considered to be the best method, as it is under better control than by some of the patent machines on the market.

In February, 1914, a trial was made of Fluxphalte, and as it is giving good results a fairly large quantity is now being used. It is applied in much the same way as tar.

Transport.—The transport of road material is by scotch cart and tramway freight cars. The former, which have a capacity of 17 cub. ft., are under the control of the sanitary department, and a charge of 8s. 6d. per day is made for the use of them. The cost per load-mile works out at about 11½d., which is equal to 1s. 3½d. per ton-mile.

The freight cars, which have a capacity of 238 cub. ft., are under the control of the tramway and lighting department. The charge made per ton per trip, irrespective of distance, is 10d., and, taking the average journey at 3 miles, gives an average cost of 3½d. per ton-mile. The termini of the tramways vary from 1·624 to 5·691 miles from the town hall. . . .

MAINTENANCE.

The maintenance of roads macadamised with minestone in the central area is a heavy item. Some of the arterial roads in the urban area have to be re-metalled about every eighteen months. In these cases the maintenance cost works out at about 10d. per square yard per annum. In one of my reports to the council on the necessity for adopting a better form of material for roads in the central area, the following observations were submitted: "In discussing a proposal of this nature it is not much use comparing the cost of minestone-macadam with a first-class asphalt, because, although such macadam is cheap and reasonably suitable for unimportant urban thoroughfares and suburban roads, especially when the surface is tarred, it is unfit for important and busy thoroughfares.

"The rapid deterioration of roads macadamised with waste rock from the mines is largely due to the soft nature of the stone, which quickly disintegrates, and is then disturbed by wind, rain scavenging and watering. Heavy watering, such as takes place within the central area, does considerable damage, and makes the surface of the road corrugated. Light watering in a dry atmosphere like ours is of very little use. Tar-coating, although highly satisfactory on suburban thoroughfares, rapidly disappears on busy roads.

"The initial cost of macadamised roads as now constructed averages about £2,640 per mile 12 yds. wide, and the cost of maintenance about £880 per mile per annum within the central area. It must, however, be remembered that in some of the busiest streets . . . the surface of the macadam soon becomes irregular, and although they may not be remetalled for periods ranging from one to three or four years, it must be conceded that the roads are far from satisfactory for a considerable portion of that time."

The advantage that good rock asphalt has over other material for road construction may be summed up briefly as follows: It has a long life—about twenty years—thus saving frequent interruptions to traffic, inconvenience to the public, and loss to shopkeepers, as in the case of macadam, especially with stone of inferior quality. It creates no dust, and so saves much damage to shop goods. It is easily kept clean, and the cost of scavenging is small as compared with minestone-macadam, from which hundreds of tons of dust and mud have to be removed. It is less noisy than macadam, and considerably reduces wear and tear on vehicles. It reduces wear on underground drains, as the same quantity of grit and detritus would not be carried into them. It is suitable for dense and constant traffic, has a neat and clean appearance, and has proved itself eminently suitable for busy thoroughfares."

CONCLUSION.

As a rule, no section of a municipal engineer's work comes in for more criticism than road making, and, no matter what he does, there are scores of people who, without knowing all the circumstances, think he is either lacking in ability or woefully ignorant of the town's requirements. One of the greatest difficulties one has to contend with is the persistence with which some people will insist that, because they have seen something done in England, America, or some other country, it should be done here—quite ignoring the fact that the conditions may be quite different.

Whitening Street Corners in St. Pancras.—To whiten the 560 corners of streets will cost the St. Pancras Borough Council £35 a week.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, assoc.m.inst.c.e.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The premium for October is divided between

Mr. J. A. Riccomini,
3 Beaconsfield-terrace,
Chatham,

and

Mr. J. G. Wilkin,
County Surveyor's Office,
Downpatrick;

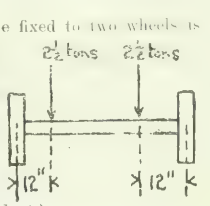
whose contributions have, in the opinion of the adjudicators, been the best received during the month.

QUESTIONS.

This week answers are invited to the following questions:—

508. Street Construction.—Some new streets are to be laid out involving considerable cutting and filling of the ground. Longitudinal sections of the ground showing the levels of the new road have been prepared. The cutting and filling have to be measured up as the work proceeds. What is the best method of doing this? (Polox.)

510. Axle Stress.—An axle fixed to two wheels is driven at the centre by a chain, and supports two bearings, distant 12 in. from the centre of the wheels, the load on each bearing being $2\frac{1}{2}$ tons. If the power exerted is 20 h.p., and the rate of turning is 30 revs. per minute, find the maximum intensity of stress in the axle if its diameter is 5 in. (Student.)



511. Tramway Construction.—Discuss spiralisation in tramway construction. (J. D., *West Hartlepool.*)

512. Hydraulic Gradient.—A horizontal main consists of 5,000 ft. of 6-in., 5,000 ft. of 9-in., and 5,000 ft. of 12-in. diameter. The velocity in the 6-in. is 12 ft. per second, and the pressure head 50 ft. at the inlet. Sketch the hydraulic gradient (*a*) supposing that only the skin friction is considered; (*b*) supposing that both skin friction and the losses of head due to abrupt changes of section are considered. Write down the expressions for the several losses of head. ("Enquirer.")

513. Hydraulics.—Calculate the percentage loss of horse-power per 1,000 yds. in hydraulic transmission through clean cast-iron pipes $4\frac{1}{2}$ in. diameter, with water velocities 2, 3 and 4 ft. per second, and with pressures 200 lb., 700 lb. and 1,200 lb. per square inch—that is, in all, 9 percentage losses, and represent your calculated results by curves. ("Enquirer.")

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

506. Concrete Sewer Construction.—Is it necessary to support concrete sewer tubes with concrete at the sides, the tubes being 21 in. in diameter? If it depends on the depth below the street whether they should be supported by concrete or not, then what are the least and greatest depths at which they can be laid without concrete support at the sides? ("Polox.")

In this question it is not stated whether the concrete tubes are reinforced or not, and whether or not these tubes should be supported and haunched with concrete must be determined by prevailing circumstances, both as regards the depth below the surface and the nature of the ground in which the tubes are being laid. Where shocks are likely to occur, as under a street carrying heavy traction and tramway traffic, it is usual to support and surround the tubes for half their depth with concrete if the tops of the tubes are less than 4 ft. from the surface of the ground. Below this depth the pressure becomes more uniformly distributed all round the tubes, and in good ground there is no occasion for concrete support at the sides. If, however, treacherous ground is encountered, such as running sand, leaving the tubes unevenly supported and liable to fracture, it will be necessary to protect the joints of the tubes by supporting them on a bed of concrete and haunching the tubes to half their depth. In cases of deep sewers in bad ground, sustaining a considerable sideway pressure, it is advisable to construct the sewers in situ. Another question bearing on this subject, and which to some extent enters into the consideration of supporting and haunching the tubes, is the nature of the excavation in which the tubes are laid. In an open trench (ordinary cut and cover) it is possible to surround the tubes with fine selected material, properly consolidated, so as to preserve them from shocks, in which case, if the ground is suitable, support at the sides could be done without. On the other hand, if the tubes are laid in a heading, it is not possible to consolidate the filling material to the same extent, and the tubes are liable to shocks from large masses of earth, improperly supported, falling upon them from the roof, in which case some side support, and even covering, is desirable. It thus appears that it is not so much the depth below the surface as the nature of the ground that governs the adoption or rejection of concrete support at the sides of the tubes. (J. G. W., *Downpatrick.*)

507. Design of Retaining Walls.—What are some good, practical rules for the design of (1) brick and (2) concrete (not reinforced) retaining walls to withstand earth pressure? ("Polox.")

The following practical rules for the design of retaining walls to withstand earth pressure have been deduced from experiment and from observation and experience of existing structures which have withstood, for a considerable period, all the usual destructive influences. (1) Brick Walls.—In walls constructed of brickwork the following dimensions are extensively adopted: The top of the wall is made 1 ft. $10\frac{1}{2}$ in. in thickness—*i.e.*, $2\frac{1}{2}$ bricks—and at every fifth course downwards, or approximately every 2 ft., the thickness is increased by half a brick, the face of the wall being generally built with a batter of 1 in 6 to 1 in 8. Occasionally a curved batter is adopted. The wall would, of course, be surmounted by a suitable stone coping.

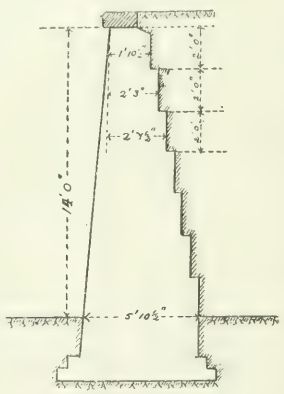


Fig. 1.

Fig. 1 shows a section of a brick retaining wall, 14 ft. high above ground level, with a batter of 1 in 8. (2) Concrete Walls.—Plain mass concrete walls are often built of the same proportions as brick or stone walls, but with this difference, that expansion joints are generally provided every 10 ft. The same rules as apply to masonry walls will therefore be applicable to concrete. For walls 6 ft. to 10 ft. high a thickness of one-fourth of the height of the wall above the natural ground is generally allowed. For walls above 10 ft. the base thickness is taken as one-third of the height above the top of the footings, the back of the wall being vertical, and the face having a batter of 1 in 6 to 1 in 8. Sometimes the method shown in Fig. 2 is adopted. The height of the wall above ground level is divided into three equal portions. The bottom portion is made equal to $\frac{1}{6}$ H, the central portion equal to $\frac{1}{4}$ H, and the top portion equal to $\frac{1}{3}$ H. Another method

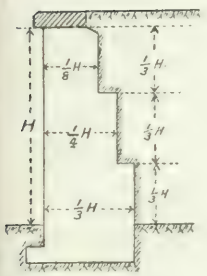


Fig. 2

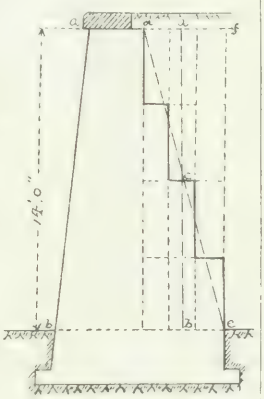


Fig. 3.

is shown in Fig. 3. The wall is first calculated with a vertical back, as described above. Suppose the thickness at the top is found to be 2 ft. Set off this thickness on the top in the point *d*, and also the height of the wall above ground level in the point *e*. From *d* draw through *c* a line to touch ground level at *c*, and from *e* draw the vertical line *ef*. Divide *df* into any convenient number of equal parts, in this case three, and produce the vertical lines to the base *bc*. Then divide *bc* into the same number of equal parts, and draw lines from the points of division to the points *d* and draw the sloping lines crossing the vertical ones. From the points of division draw the lines forming the offsets, as shown in the figure by the thick lines. The effect of stepping the back of a wall in this fashion increases the friction of the earth against it, giving increased stability, and therefore offering a greater resistance to overturning. The wall contains no more material, and as the offsets are easily formed, it is much better to convert a wall with a vertical back into the above form.

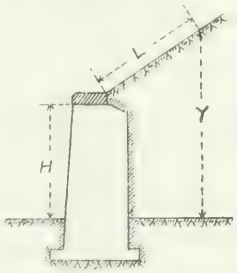


Fig. 4.

Surcharged Walls.—Where a retaining wall is surcharged—*i.e.*, retains a bank which slopes upward to a higher level than the top of the wall—the thickness, according to the foregoing rules, must be increased. This class of wall is principally made use of in cuttings, and in some cases walls of this description are built to retain the toe of an embankment, so saving large quantities of earthwork. Fig. 4 shows how the dimensions for this form of wall are arrived at. The height Y is substituted for H, or the height of the wall from ground level, and is the perpendicular at the end of a line L, equal to H, measured along the slope to be retained. The value of Y will necessarily vary with the slope, the extent of variation being shown in the following table:—

Y =	1·71 H	in slopes of	1 to 1
	1·55 H	„ „	1½ to 1
	1·45 H	„ „	2 to 1
	1·30 H	„ „	3 to 1
	1·24 H	„ „	4 to 1

It will therefore be seen that a wall calculated to retain earth on a level with its top must be increased ·71 in thickness to retain a slope of 1 to 1, and so on with the remaining values of Y. The foundations of all walls should be carried down to a sufficient depth to be below the disintegrating effect of frost. From 2 ft. to 4 ft. is considered a safe depth for this purpose. Where the supporting earth is of an unstable character, the area of the foundations may be increased to any desired extent by forming steps beyond the thickness of the wall proper, so that the weight of the structure may be distributed over a large surface. Weepholes, formed of 2-in. or 3-in. pipes, should be provided to drain off any water which may collect behind the wall, one to every 2 or 3 yds. super. of wall face; while in the case of brick retaining walls, or walls constructed in masonry, it is much better to have these pointed in cement, as there is a tendency for moisture to find its way into the interior of walls which batter. (W. A., *Ilfracombe.*)

(1) Brick Retaining Walls for Earth.—(1) A good rule is to make the thickness of the wall at top 1 ft. 10½ in., and every fifth course downwards to increase the thickness by half a brick (4½ in.), the face of the wall to have a batter of 1 in 8 or 1 in 12. (2) Trautwine's rule for thickness of brick retaining walls, which sustain a backing of sand, gravel, or earth level with the top, is to make the thickness at the bottom 1 foot in height, when the retaining wall is also 3 ft. deep.

(2) Concrete Retaining Walls for Earth.—(1) For retaining walls 6 ft. to 10 ft. high a thickness of ¼ height of wall above ground level is generally allowed. In large structures the height of the wall above ground is divided into offsets, and the thickness varied from ¼ height at the base to ⅓ height at the top. The effect of stepping the back of the wall increases the friction of the earth against it, giving increased stability. (2) Practical formula given in "Hurst's Pocket-book," based on Prof. Rankine's investigations—

T = thickness of wall with vertical sides.
T = mean thickness of wall with either face or back sloping (= thickness halfway up).
H = height of wall.
= weight of cubic foot of earth back of wall.
W = weight of cubic foot of wall.
K = ·7 tan $\left(\frac{90 - \theta}{2}\right)$ where θ = angle of repose of earth.

Case (*a*). Wall with vertical sides and backing horizontal at top—

$$T = K H. \sqrt{\frac{w}{W}}$$

Case (*b*). Sloping walls with vertical back—

Batter of face ¼", T_1 = 0·86 T.
½" T_1 = 0·80 T.
¾" T_1 = 0·74 T.

Case (*c*). Wall with vertical face and sloping back, or with offsets—

T_1 = 0·85 T.

Sir Benjamin Baker states that, as the result of his own experience, "the thickness of retaining walls in ground of an average character should equal ¼ height from the top of the footings," and also that "a wall ¼ height in thickness and a batter of 1 in. or 2 in. per foot-run on the face possesses sufficient stability where the backing and foundation are both favourable," and also that "under no ordinary condition of surcharge or heavy backing is it necessary to make a retaining wall on a solid foundation more than ¼ height in thickness."

(3) Retaining Walls for Water.

Thickness at bottom = height × ·7
„ „ middle = height × ·5
„ „ top = height × ·3

These practical rules are very useful for trial sections, and for checking calculations made by other and more accurate methods. In general they will be found to err on the side of safety. (J. G. W., *Downpatrick.*)

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings.—Dundee.—North Riding: roads and materials.—Bridlington, East Barnet, Notts: sewerage and sewage disposal.—Wigton: water, gas and electricity.—Barrow-in-Furness, Bo'ness.—Particulars of other projected works will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Ardrossan T.C. With respect to the proposed joint hospital with Saltcoats, the owner of the site has written insisting upon the erection of a permanent stone structure instead of an iron building as proposed, and the communication has been forwarded to the Local Government Board.

Dundee T.C.—Tenders amounting to £56,000 have been accepted for the erection of the new city hall.

Mitcham U.D.C. Plans have been approved of a proposed mortuary at Lonesome.

North Riding C.C. It has been decided to carry out extensions of the borough police-court near Richmond, at an estimated cost of £1,100.

Preston T.C.—The Local Government Board have vetoed the proposal to raise any further money in respect of the public baths, and the work will accordingly be brought to a standstill.

HOUSING AND TOWN PLANNING.

Chorley T.C.—The Town Planning Sub-Committee are considering the report prepared by the borough surveyor, Mr. G. H. Hopkinson, on the town planning scheme.

Earsdon U.D.C.—A resolution has been passed to prepare a town planning scheme.

ROADS AND MATERIALS.

Bridlington T.C.—The corporation are recommended by the Highways Committee to carry out road repairs at an estimated cost of £1,120.

Broadstairs U.D.C.—The surveyor, Mr. H. Hurd, has received instructions to prepare specifications for making up Afghan-road.

Darlington R.D.C.—The slippery state of the roads and consequent danger to horses was discussed at the last meeting. The surveyor (Mr. W. J. Pallister) stated that he was putting grit on the roads, but as there were now such lengthy stretches tar-sprayed, he suggested that the council should authorise him to ascertain the prices of horse-drawn gritting machines. It was stated that in several places accidents were a regular occurrence, and the chairman said that where width permitted, the surveyor should leave a margin of 5 ft. of ordinary macadam on each side of the road. The surveyor was instructed to make inquiries about the machines.

Easingwold R.D.C.—The highway surveyor, Mr. G. Thompson, reported that he had been unable to recommence continuous rolling owing to the tardy deliveries of slag and the shortness of water in most districts. With reference to a letter from the county surveyor on the subject of economy in main road expenditure he estimated that he would underspend the estimate for the York and Northallerton main road by £230, and that for the York and Oswaldkirk main road by £120, a saving of 20 per cent on the original estimated expenditure of £1,682.

East Barnet U.D.C.—The engineer and surveyor, Mr. H. York, has been instructed to obtain prices of carts for distributing gravel on the roads in frosty weather.

Hailsham R.D.C.—At the request of Mr. Roland Burke, of the Royal Engineers, it has been agreed to prepare particulars for the improvement of the road between Eastbourne and Cooden, with the object of obtaining a grant from the War Office to meet the cost of the work.

Horsham R.D.C.—At the last meeting the surveyor was instructed to proceed with the work of making roads at the Roffey Camp, at an estimated cost of £354, which would be borne by the War Office.

Leyburn R.D.C.—It has been decided to offer Messrs. Wear & Co., Hexham, 3s. per hour for the hire of steam road rollers.

Martley R.D.C.—The surveyor, Mr. H. L. Richardson, reported that the economies effected on the roads during the six months ending September 30th amounted to £897.

Newhaven U.D.C.—The surveyor, Mr. C. T. Hooper, has received instructions to prepare estimates in connection with the construction of a further length of road in the Meeching Rise Camp.

Newton Abbot U.D.C.—The council have accepted a sum of £250 from the governors of the Seale-Hayne College in full settlement of the damage caused to roads by extraordinary traffic in connection with the erection of the Seale-Hayne College.

Notts C.C.—It was reported recently that heavy military traffic had been passing over the Worksop and Kelham road from Ollerton and Worksop to the camp at Thoresby, and the damage and deterioration would involve an expenditure of £2,032. At the request of the Road Board the Highways Committee had undertaken to reform and surface about 1¼ miles of road from the Traveller's Rest to Cavendish Lodge on behalf of the military authorities, who would refund the cost.

Radstock U.D.C.—The surveyor, Mr. G. H. Gibson, presented a report upon the completion of the work of tarring and sanding the main roads, and stated that by hiring a machine, and having the work done by their own horses and men, the council had saved over £36 compared with the price the contractor, recommended by the county council, was prepared to do the work for. A considerable saving was also effected in the work done on the district roads.

Sheffield T.C.—In reply to a criticism of the town council's policy of asphalting roads, Councillor Angell said the justification for the use of asphalt was found in the fact that as far as they could ascertain not one horse per day went down. He did not think there was any city which could show a better record than that. Much of the asphalt was put down recently because of the difficulty in getting wood. In the near future they would have to suggest something other than wood paving in consequence of the scarcity of suitable material. Before they decided upon any new material everything connected therewith would be most seriously considered.

Stockton R.D.C.—The completion was reported of the widening of the main road at the east end of Longnewton, and the construction of a length of new road between Elton and Longnewton. It was stated that the Road Board would make a contribution of £500 towards the cost.

SEWERAGE AND SEWAGE DISPOSAL.

Brightlingsea U.D.C.—Dr. Kevern, in his report, emphasised the advisability of the council insisting upon all dustbins being of galvanised iron or tin and covered, and also upon the abolition of hand-flushed closets.

Hexham R.D.C.—A statement of expenditure in connection with the Broomley sewerage scheme was read, and it was reported that the expenditure showed that £630 had been overspent. With regard to the method of raising this sum it was decided to make application for a loan.—A letter and statement with regard to the contractor's loss of £1,201 on this sewerage work were read. The contractor made an appeal to the council to assist him to make up his loss, but it was decided that no payment be made to the contractor, as the district was already over-burdened.

Lewes T.C.—Councillor Wyborn, at the council meeting last week, expressed appreciation of the work of Alderman Every in regard to the sewage works, and then informed the council that the work of the repair of the Winterbourne culvert had been practically finished, at an approximate cost of £1,829. They could congratulate themselves, the borough surveyor (Mr. D. Roberts), and his foreman, on the very satisfactory job they had made of it.

Maidstone T.C.—The borough surveyor, Mr. T. L. Bunting, has received instructions to proceed with an extension of the surface-water sewer in Brunswick-street.

Rotherham R.D.C.—It has been decided to purchase a new engine and pump for the Laughton sewage disposal works, at a cost of £150.

Wigton R.D.C.—It is proposed to carry out works of sewerage at Hayton.

WATER, GAS, AND ELECTRICITY.

Barrow-in-Furness T.C.—A report has been prepared by the borough engineer, Mr. Arthur Race, and the waterworks manager, recommending an extension of the water supply at an estimated cost of £5,000, £3,000 of which will be contributed by Messrs. Vickers.

Bawnboy (Co. Cavan) R.D.C.—The tender of the Ballyconnell Electric Light Company has been accepted for lighting the town by electricity.

Bodmin U.D.C.—It has been agreed to give facilities to a contractor for the construction of the proposed water supply, subject to an option of purchase by the council should it be decided to proceed with a comprehensive scheme of main drainage.

Bo'ness T.C.—It is proposed to extend the electricity works at an estimated cost of £7,000, and to provide temporarily two 100 kw. Diesel oil engines.

Colwyn Bay U.D.C.—The question of installing plant at the gasworks for the distillation of tar has been referred to a special committee.

East Lothian C.C.—An expenditure of £1,300 has been authorised for the extension of water supply mains.

Finchley U.D.C.—The Electricity Committee recommend the council to carry out electricity main extensions, at an estimated cost of £239.

Leicester T.C.—The nett profit of the gas undertaking for the last half-year, after paying interest on the capital was £23,784.

Newport (Mon.) T.C.—The corporation waterworks show a surplus of over £2,000 and the Waterworks Committee are considering whether the amount shall be used in easing the rates by the liquidation of debts or in reducing the water charges.

Stockport T.C.—A letter had been received from the Ministry of Munitions, stating it was noted with great satisfaction that the Stockport gas department had succeeded in obtaining a considerable increase in the toluol contents of tar by the adoption of Dr. Carpenter's process, and it was hoped the department would be able to wash the whole make of coal gas with the entire make of tar, in which case the total result in toluol obtained would be most valuable.

Wimbledon T.C.—It has been decided to apply for a Provisional Order to supply electricity to the parish of Cuddington.

MISCELLANEOUS.

Cardiff T.C.—In a report to the Finance Committee, the auditors, dealing with the electric light department, point out that there is a surplus of £5,924, compared with £4,539 in 1913-14, £4,181 in 1912-13, and £2,459 in 1911-12, figures which indicate the continual growth of the department. The total capital expenditure of the department had now reached £303,933. In the waterworks department the expenditure for the year was £92,100, against which the income was £80,309—leaving a nett deficiency of £11,791. The rate in aid realised the sum of £12,469, leaving £678 as credit, which is carried forward to next year's account. The capital expenditure had amounted to £1,552,321. Comparing the chief accounts of the District Fund for the past three years, the report shows that highways maintenance had declined from £21,649 during 1912-13 to £20,969. Public improvement expenses had decreased £1,000 over the same period; street lighting had increased £200; but the surplus from motor licences, &c., was £400 higher. Street cleansing costs were £3,000 up, but the cost of Roath Park had decreased by £800.

Ripon T.C.—It was reported that representatives of the Water Committee had attended a conference with representatives of the Ripon and Wath Rural District Councils with reference to the purchase of a fire engine for Ripon and district. The conference had suggested that a steam fire engine be purchased at a cost of about £200 or £250; that the cost be apportioned amongst the three councils, according to assessable value; and that the annual upkeep be divided—one-half to the city, and one-half to the rural districts.

Wigan T.C.—The town council have adopted the proposal of the borough engineer, Mr. A. T. Gooseman, to defer the erection of the new roof over the manure pits at the Miry-lane depot, but have decided to purchase oilskins for the men working at the manure pits. This will effect a saving of £372.

PERSONAL.

Mr. M. Dolan, assistant county surveyor of Roscommon, has resigned.

Mr. R. W. Hindhaugh, surveyor to the Ham (Surrey) Urban District Council, has been voted an increase of salary.

Mr. F. Oscar Kirby, M.INST.C.E., borough surveyor of Doncaster, has been gazetted Second Lieutenant in the Kent (Fortress) Royal Engineers.

Mr. J. H. B. Kirton, surveyor to the Withernsea Urban District Council, has been released from his duties during the war to take up munition work.

Mr. James A. Caskey, engineering assistant in the Derry county surveyor's office, who has joined the Colours, has been voted half salary by the county council during his absence.

Mr. P. C. Woodhall, engineer and surveyor to the Uttoxeter Urban District Council, was on Tuesday last unanimously granted an increase of salary of £30 per annum.

Mr. A. J. Redfern, sanitary surveyor to the Honiton Rural District Council, has been granted permission to act as expert adviser to the Axminster Rural District Council during the absence of the latter council's inspector on war service.

Mr. W. C. Persey, chief assistant in the borough engineer's department, has been appointed borough engineer and surveyor of Barrow for a period of twelve months, at a salary of £375, in succession to Mr. Arthur Race, who has been appointed borough surveyor of Blackburn.

Messrs. Ellis and Parry, district road surveyors to the Sleaford, Lines, Rural District Council, have received permission to join the Army when called up under Lord Derby's scheme, and the surveyor, Mr. W. B. Marsden, has been authorised to obtain assistance to carry out their duties.

Mr. H. G. Crothall has voluntarily offered to the Middlesex County Council that, during the suspension of the works in connection with the proposed new sanatorium and the new lunatic saylum, his salary should be paid at the rate of £1,000 instead of £1,200 per annum, as authorised by the council in May last. The council have accepted the offer.

Mr. Charles Jarrott has been unanimously elected vice-chairman of the Executive Committee of the Automobile Association and Motor Union. He fills the vacancy caused by the retirement of Sir Archibald Macdonald a few months ago, and will act jointly with Mr. C. H. Dodd, who has held the position since the amalgamation of the association with the old Motor Union in 1910.

Mr. E. J. Stead, county surveyor of Somerset, having accepted a commission in the Army, the county council have agreed to the following appointments pending his absence: (*a*) Mr. G. R. Foland to be acting county surveyor at a salary of £200 per annum, together with an allowance of £30 for upkeep of a motor cycle; petrol to be provided at the expense of the county council. (*b*) Mr. Stead's motor car to be purchased by the county council for a total sum of £75, Mr. Stead to repurchase the car on his return at a sum to be fixed by valuation, and the car to be run in the meantime at the expense of the county council. (*c*) Mr. Charles R. Cole to be appointed second assistant surveyor, at a fixed salary of £135, together with an allowance of £30 for a motor cycle. (*d*) Offers of professional assistance kindly made by Mr. Cotterell, of Bristol, and Mr. Gettings, county surveyor of Worcestershire, to be considered and accepted by the chairman if occasion should arise hereafter.

OBITUARY.

MR. W. H. WHEELER.

Mr. W. H. Wheeler, formerly borough surveyor and harbour master of Boston, died recently, we regret to state. He was the designer of Boston Dock.

HUNTINGDON BOROUGH SURVEYOR.

Mr. E. Borissow, borough surveyor of Huntingdon, has, we regret to state, succumbed to enteric fever in the Dardanelles, after having been wounded. He was attached to the special sanitary section of the Royal Army Medical Corps.

NORFOLK COUNTY SURVEYOR.

We have to announce, with regret, the death of Mr. T. H. B. Heslop, county surveyor of Norfolk, at the

age of sixty-five. He had been a sufferer from heart trouble, and in August last he went to Harrogate for a period of rest and recuperation. He appeared to have benefited considerably from the change, and was engaged in his official duties up to Saturday last, when he attended a meeting of the Road Tarring Committee. The end came suddenly on Monday at his residence, Edgewood, Eaton. Mr. Heslop was appointed county surveyor of Norfolk in 1885, in succession to the late Mr. R. M. Phipson, and Mr. R. M. Brereton, who had held what was practically a joint position. During his tenure of office of thirty years he was engaged in many important undertakings, and at the time of the great flood in 1912 rendered valuable service in meeting the difficulties then presented, and afterwards in repairing the damage done. In the work of road construction he took a high position, and the condition of the county highways bears testimony to his skill and industry. Mr. Heslop was a member of the Institution of Civil Engineers, and hon. secretary and treasurer of the County Surveyors' Society. He leaves a widow, two sons, and one daughter. The funeral will take place at Old Eaton Church to-day (Friday), at two o'clock.

Mr. A. B. McDonald.

Mr. A. B. McDonald, M.INST.C.E., late city engineer of Glasgow, died, we regret to state, on Sunday last, as the result of a fall while stepping on to a tramcar on the previous day. He was in the service of the Glasgow Corporation for forty-five years, and for twenty-five years he held the position of city engineer. He was sixty-eight years of age. Mr. McDonald was a native of Stirling, and was educated at the High School of that town, and at Glasgow University. Having served his pupilage with a private firm of engineers and surveyors in Glasgow, he became head assistant at their office. In 1870 he joined the corporation service, and was soon afterwards appointed chief assistant to the late John Carrick, M.INST.C.E., F.R.I.B.A., master of works and city architect. On the death of Mr. Carrick, in 1890, Mr. McDonald was by unanimous vote of the corporation appointed his successor to the title of city engineer. With Mr. Carrick Mr. McDonald worked out the details of the Glasgow city improvement scheme, which involved a total expenditure of about £1,750,000. Mr. McDonald was the architect of the Ruchill Hospital, the cost of which amounted to £280,000, and besides designing various bridges and other works he designed and constructed, in collaboration with Sir Benjamin Baker, the Glasgow tidal weir, which involved a capital outlay of about £80,000. He was the engineer of the Glasgow main drainage scheme, the second largest in the world, costing £2,250,000, and, in addition to his practical work, he was able to devote some time to literature, having written upon the housing question and kindred subjects. He was president of the Scottish branch of the Incorporated Association of Municipal and County Engineers, and after its amalgamation with the parent institution, served for some time on the council, attending numerous meetings in London for the purpose. Among municipal engineers he occupied a high place, and he was frequently called to give expert evidence for schemes promoted by large municipalities. Mr. McDonald retired on pension in June last.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Hornsey T.C. (October 28th. Mr. R. H. Bicknell). £5,800 for the erection of buildings adjoining the refuse destructor and the provision of machinery for the manufacture of bituminous clinker road materials.

The borough engineer, Mr. E. J. Lovegrove, M.INST.C.E., said it was proposed to provide permanent plant to take the place of temporary hired plant which had been used during the past two years. The material was manufactured from prepared clinker from the refuse destructor mixed with bitumen, for single or two-coat bituminous road work or grouting. A considerable area had already been laid in the borough—about 9,000 yds. super. in 1914, and 11,000 yds. super. in 1915. Prior to the adoption of this class of material the reconstruction of the road crusts was carried out in various classes of bituminous work. Mr. Lovegrove offered proof of the financial advantage of the adoption of the new material. In Park-road, Crouch End, work having an area of 6,618 yds. super. was forced upon the town council by a new motor 'bus service, and was carried out for £1,096 less than if asphaltic macadam had been used. In two other cases this season sections of Muswell Hill-road and Endymion-road, Finsbury Park, had, with the assent of the Road Board, been resurfaced as part of a reconstruction of road-crust scheme. The estimate for these two sections in asphaltic macadam was £2,130; the actual cost in clinker asphalt amounted to £1,275, being a reduction on the original estimate of £855. In one section, laid in 1914, the surface had been carrying a service of double-decked motor 'buses and heavy steel-tyred coal and goods vans from the railway goods yard. In another instance, laid in 1914, the traffic ranged from 312 tons to 494 tons per yard-width of road, including motor 'buses. The material had excellent wearing qualities, and during hot weather did not become too soft. On the hottest days the effect of the traffic was merely to make impressions which were subsequently removed as the temperature lowered. It was estimated that the minimum saving in labour and hired plant, if permanent machinery was installed, would be £25 11s. per week, and, assuming a twenty weeks' working season, this would represent the sum of £511 per annum towards the repayment of capital outlay. The estimated cost of the buildings was £2,200.

Todmorden R.D.C. (October 27th. Mr. P. M. Crosthwaite).—£700 for purposes of water supply for the Colden district of the parish of Heptonstall.—Mr. J. E. Craven stated that the council had purchased a messuage which contained a well, and had erected a cistern on the top of a building, and a windmill to pump the water into it. All the work was complete, and £615 had already been paid on it out of the general fund of the council. The inspector wished to know why borrowing powers were not sought before the works were commenced. Mr. Craven said there was a pressing necessity for the work to be carried out. Mr. Holmes, a sanitary inspector for the West Riding County Council, said that since an outbreak of fever in 1905, the county council had been pressing the district council to provide a new supply for the Colden district and for the village, and were undoubtedly of opinion that such a scheme should be carried out.

APPLICATIONS FOR LOANS.

Gloucester T.C. £25,000 for generating plant and mains.

Salford T.C. £1,226 in connection with the electricity undertaking.

Shoeburyness U.D.C. £2,000 for extensions to the sewage tank.

LOANS SANCTIONED.

Cornwall C.C.—£1,230 for the proposed sanatorium at Castle-an-Dinas.

Essex C.C.—£800 for the purchase of a site at Earls Colne for a school.

LOANS REFUSED.

Ayr C.C. £2,000 for the erection of roadmen's houses in Carrick.

Ilford U.D.C.—£870 for the erection of an engine-room in connection with the refuse destructor.

Rhondda U.D.C.—£17,000 for works of drainage.

Wolverhampton T.C.—£5,000 for electricity mains, and £2,000 for sanitary improvements.

FORTHCOMING INQUIRIES.

NOVEMBER.	£
8. **Cardiff.** For the purposes of the fire brigade (Mr. W. O. E. Meade-King) ...	5,300
9.—**Alsager.** For works of water supply (Mr. H. Shelford Bidwell)	680
9.—**Chertsey.** For works of sewage disposal (Mr. P. M. Crosthwaite)	8,030
9.—**Walton-le-Dale.** For main road reconstruction (Mr. A. W. Brightmore) ...	17,950

Successful Retford Undertakings. — The annual report of the Retford waterworks shows that the whole of the liabilities have now been paid, so that the town possesses up-to-date works and an excellent supply of water free from any debt or loan. The thirty-ninth annual report of the gas undertaking shows that the only liability now remaining is a loan of £16,431, although the nominal value of the works stands at £56,733. A credit balance of £8,138 is used as a trading account, and is invested in Consols. There is a nett profit of £905 on the year after paying interest and instalments on the loan.

BATHS AERATION AND FILTRATION PLANT.

On the occasion of the North-Eastern District meeting of the Institution of Municipal and County Engineers at Brighouse recently, the members of that body were afforded an opportunity of inspecting the aeration and filtration plant at the public baths.

The plant is that of the "Turnover" Filter Company, of Belfast, with whom Messrs. J. Blakeborough & Sons, of Brighouse, are connected, and practically the whole of the plant, with the exception of engine and pump, was made in the town.

The capacity of the plant is 10,000 gallons per hour, and as the plunge bath contains 67,000 gallons, the whole of the water is withdrawn, aërated and filtered once every six to seven hours, or actually twice per day during the summer season.

The engine is 9-h.p., by Marshalls, of Gainsborough. The engine also drives a 3-h.p. dynamo, so that the building is lighted and the laundry machinery worked by current generated from the spare power developed by the engine. The shafting operating the pumps and the filters during washing operations is so arranged that it can be ultimately used for the steam laundry when extensions are made.

The size of the filter is about 6 ft. diameter by 7 ft. in length, giving a filter area of about 40 sq. ft., the filtering material consisting of a layer 2 ft. 6 in. deep of crushed Norwegian quartz. A section of the filter and a sample of the filtering media were shown at the meeting.

The pumps are [illegible] pumps, working at 1,500 revolutions per minute, the two pumps being fixed on the same shaft to ensure the same rate of flow through both the aërator and the filter. The first pump withdraws the water from the deep end of the bath, and after it has passed through a straining filter, where the hair and fibrous matter are retained, lifts the water to the aërator, where weak solutions of lime and alumina-ferric are added. The water is here reheated, if required, by the exhaust steam from the engine passing through a coil in the lower part of the aërator. The water then flows from the aërator to the second pump, which delivers it into the filter, and after passing through the quartz it is returned to the shallow end of the bath.

The filter, as its name implies, is so fixed that it can be entirely turned over or revolved; but this only occurs during the actual washing-out process, the method being to cut off the circulation through the plunge bath, and to utilise the water remaining in the filter for the first washing. The filter is rocked from side to side to break the skin of impurities lying on the surface of the media, by causing the grains of quartz to roll over each other. The dirty water is then syphoned off to the sewer, and the filter again filled with water from the overhead storage tank. It is again rocked to a greater extent, and the water once more syphoned off. Finally, to ensure thorough cleansing, the filter is entirely rotated and brought back to its original position.

Any deposit that may accumulate on the floor of the swimming pond is removed by long brushes, which sweep the sediment to the deep end, where it is sucked out into the strainer, while the surface of the pond is periodically skimmed to remove any dust that falls on it, as, if this is not attended to carefully, an otherwise very clear water appears to be in indifferent condition.

Road Surfaces in the North Riding.—Alderman H. Hawking, in submitting the minutes of the North Riding Highways and Bridges Committee recently, said numerous complaints had been received as to the slippery condition of the roads at this time of the year. The committee had done the best they could in putting grit on the roads, but this had been interfered with owing to the shortage of labour. At the earliest opportunity the committee would deal with the question of roughing the surface of the roads, but it should be borne in mind that this would probably lessen the life of the roads, and so add to the cost of their upkeep. During the past four years various sums had been received from the Road Board, but these amounts were dependent on the use of tarred materials, and the committee had only been acting according to instructions. Mr. A. Smith [illegible] said the material used had not been properly mixed, and in view of the number of accidents that had taken place in the Riding it was time something was done to remedy matters.

INSTITUTION OF CIVIL ENGINEERS.

PRESIDENTIAL ADDRESS.

In his opening address on Tuesday evening as president of the Institution of Civil Engineers, Mr. Alexander Ross said that while each one of us, according to his ability and opportunity, was endeavouring to do his best for the national cause, and for the success of the British arms, we could not ignore the fact that the circumstances had involved great sacrifices among professional engineers, and he feared we must look for a certain amount of distress to follow. Professional engineering work had been adversely affected to an extraordinary degree by the need, which was realised by all, of husbanding the national resources and arresting the prosecution of a large number of those undertakings which in the usual course employed professional engineering skill.

While sharing the view that much expenditure and application of labour which was not directed to military needs should be suspended for the present, we might well doubt whether it was a truly economical course to postpone, even under the present circumstances, the contemplation and professional consideration of engineering works, for which the call might be expected to be acute when the war was over. It appeared to him that many engineers whose age and circumstances prevented them from taking an active part in connection with the war might well be devoting their skill to the deliberate preparation of such projects as he had referred to. The cost necessarily involved would be very small, and there could be little doubt that the country would be in a better position to resume normal activities in the future, if effort which could not be made use of otherwise were applied to the preparation of designs for work which was certain to be undertaken under some pressure when the time came.

Another matter which must exercise our minds in connection with the future of many of the young men who had volunteered to serve the country was what will be the position of those of them who had embarked upon or contemplated an engineering career, which had been completely broken off? It was impossible to create a competent engineer without due training and experience, and we would no doubt have to consider somewhat specially, at a later date, the position of those young men whose preparation for the engineering profession must be, owing to the war, regarded as imperfect, according to the existing rules of the institution.

In the course of his remarks Mr. Ross stated that already some 1,500 of the younger members of the institution had joined His Majesty's forces, for the most part in the commissioned ranks.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. W. H. Matthews Jones, City Engineer and Surveyor, Chester.

President-Elect—Mr. Henry C. Adams, M.Inst.C.E., M.I.M.E., M.I.E., F.R.San.I.

The seventh annual general meeting will be held in London on Saturday, November 27th.

Programme.

11.30 a.m.—Council meeting.

11.45 a.m.—Meet in the council chamber, No. 4 Southampton-row, W.C.

12 noon.—Annual general meeting.
Minutes of last meeting.
Presentation of annual report of council.
Announcement of result of ballot for election of council for the year 1915-16.
Installation of president.
Any other business.

1 p.m.—Adjourn for lunch.

2.30 p.m.—Reassemble in council chamber.

2.45 p.m.—Presidential address.
Discussion on the following papers to be presented to the meeting:—
"The Manufacture of Cement," by Horace Boot (past-president).
"The Benefits Derived by an Urban District Adopting a Town-planning Scheme," by W. L. Carr (member).

Advance copies of papers may be obtained on application to the secretary, and will be forwarded as soon as the papers are in print.

Ladies are invited to attend the meeting.

B. Wyand,
39 Victoria-street, S.W. *Secretary.*

ROYAL SANITARY INSTITUTE.

A sessional meeting will be held on Friday, November 12th, in the Town Hall, Ripon, jointly with the Yorkshire branch of the Society of Medical Officers of Health, when a discussion will take place on "The Construction and Working of the New Camp Sewage Works," to be opened by Mr. Arthur W. Smith (manager of the military camp sewage works).

The chair will be taken at 10 a.m. by Prof. Kenwood, M.B., D.P.H., F.R.S.E. (Lieut.-Colonel R.A.M.C.).

Tickets for admission of visitors may be had on application to Dr. W. D. Jefferson, medical officer of health, North House, Ripon, who is kindly acting as the local hon. secretary of the meeting; and of Mr. E. White Wallis, secretary.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

BOROUGH SURVEYOR.—November 12th.—Corporation of Buckingham. £150 a year.—Mr. Geoffrey M. Barker, town clerk, Buckingham.

HIGHWAY SURVEYOR.—November 19th.—Droitwich Rural District Council. £150 per annum.—Mr. A. J. Bearcroft, clerk, Council Offices, Droitwich.

ENGINEER-IN-CHARGE. — November 22nd.—Thakeham Rural District Council. 32s. per week.—Mr. Percy Ayling, clerk, Council Offices, Storrington, Sussex.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

YORK. — November 30th.—Schemes under the Housing and Town Planning Act, 1909, in connection with certain areas within and without the city of York, for the corporation. Premiums, £100, £50 and £25.—Mr. F. W. Spurr, city engineer, Guildhall, York.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

CASTLEBAR.—November 6th.—For the erection of four bridges to cottages, for the urban district council.—Mr. F. Ryan, acting clerk.

BELFAST.—November 9th.—For the erection of a [illegible] district council.—Mr. R. G. Jackson, clerk, Council Office, The Workhouse, Belfast.

CROMBIE.—November 9th.—For the erection of thirty-four cottages, for the Commissioners of Works and Public Buildings.—H.M. Office of Works, 3 Parliament-square, Edinburgh.

HITCHIN.—November 9th.—For the erection of 100 cottages, for the rural district council.—Mr. A. E. Passingham, clerk, Hitchin.

EDMONTON.—November 9th.—For the erection of a cleansing station, for the urban district council.—Mr. Cuthbert Brown, engineer.

ST. HELENS.—November 17th.—For the erection of an engine-house and other works, for the Electricity Committee.—Mr. E. M. Hollingsworth, borough electrical engineer.

KILKENNY.—November 30th.—For the construction of a reinforced-concrete bridge, for the Kilkenny and Wexford County Council.—Mr. A. M. Burden, county surveyor, Kilkenny.

Engineering: Iron and Steel.

FRASERBURGH.—November 6th.—For the construction of a corrugated steel and timber lifeboat-house and concrete slipway, for the Royal National Lifeboat Institution.—Mr. J. Wallace Tarras, Town House, Fraserburgh.

CASTLEBAR.—November 6th.—For supplying and laying 550 yds. of 2-in. cast-iron water main, for the urban district council.—Mr. E. K. Dixon, surveyor.

NAPIER.—November 9th.—For the supply of two gas engines, two direct-current electric generators, two switchboard panels, spares, and other apparatus necessary for the control of the plant, for the borough council (New Zealand). — Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

EDMONTON.—November 9th.—For the supply and erection of a vertical steam boiler, and re-erection of disinfector, with necessary steam piping and accessories, for the urban district council.—Mr. Cuthbert Brown, engineer, Town Hall, Edmonton.

LONDON.—November 10th.—For the supply of steam and hot-water heating accessories, for the Commissioners of Public Buildings.—Controller of Supplies, Office of Public Works, 18 Queen Anne's-gate, Westminster, S.W.

SOUTHAMPTON.—November 12th.—For the supply of about 9 tons of rolled steel tees and channels, for the corporation.—Waterworks Engineer, 33-35 French-street, Southampton.

MADRAS.—December 16th.—For the supply and delivery of 15-ft. diameter cast-iron wall sluices, with gun-metal faces, adjustable wedge blocks, pillars and headstocks, for the corporation. — Messrs. James Mansergh & Sons, agent, 5 Victoria-street, Westminster, S.W.

ATHENS.—December 17th—30th.—For the maintenance and working of the undertakings necessary for the water supply, and laying a distributing system.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

DUNDEE.—November 23rd.—For the construction of steel roof span for the new city hall, for the corporation.—Mr. J. Thomson, city architect.

JOHANNESBURG.—December 30th.—For the supply and erection of ice-making and refrigerating plant, for the municipal council. — Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

Roads.

EASTBOURNE.—November 8th.—For making up certain passages, for the corporation.—Mr. A. E. Prescott, borough surveyor, Town Hall.

MANCHESTER. — November 9th.— For paving, sewering and draining certain streets, for the corporation.—Paving Department, District Surveyor's Office, Town Hall.

NORWICH.—November 9th.—For the supply of granite for the year ending December 31st, 1916, for the county council.—Mr. T. H. B. Heslop, county surveyor, The Shirehouse, Norwich.

CHELMSFORD.—November 11th.—For the supply of Guernsey granite, 2-in. or 1½-in. gauge, for the corporation. — Mr. G. Melvin, town clerk, Municipal Offices.

NORTH DARLEY.—November 12th.—For the supply of granite macadam, for the urban district council.—Mr. E. F. Lowe, surveyor, Council Offices, Two Dales, Matlock.

LEWISHAM.—November 17th.—For making up Manwood-road, Crofton Park, for the borough council.—The Surveyor, Town Hall, Catford, S.E.

CAMBRIDGESHIRE. — December 17th.—For the supply of broken granite, basalt and slag, for the county council.—Mr. H. H. Dunn, acting county surveyor, The County Hall, Cambridge.

Sanitary.

ABERDEEN.—November 2nd.—For the construction of 50 yds. of pipe sewer, with ventilating manhole, for the corporation.—The Surveyor, Town House.

BROWNHILLS. — November 15th. — For laying stoneware pipe sewers and manholes, for the urban district council.—Mr. J. H. Shaw, engineer and surveyor, Brownhills, Staffs.

CHEPPING WYCOMBE.—December 6th.—For the supply of stoneware pipes, for the corporation.—Mr. T. J. Rushbrooke, borough surveyor.

Stores.

BRADFORD.—November 13th.—For the supply of materials for the tramways department.—Tramway Offices, 7 Hall Ings, Bradford.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. NOVEMBER 12, 1915. No. 1,243.

Minutes of Proceedings.

Electrolytic Sewage Treatment.

On several occasions in the past we have discussed in these columns recent schemes of sewage treatment by what is known as the electrolytic process, but in most cases the tests have not been sufficiently practical, or of sufficient duration, to enable any prospect of the system becoming of practical value to be made. A recent issue of New York *Municipal Engineering*, however, contains a full description, and appears to be the first publication to record the results of operations for some time at Durant, Oklahoma, and gives the results of tests recently made by the State bacteriologist. In this, the latest scheme which has come to our notice, we find that the special method of treatment has been applied in a much more practical manner than heretofore. In the first place, no attempt has been made to effect the oxidation or suspension. These are removed in a settling tank well arranged to remove heavy and floating solids, and then passed to the electrolytic tanks. Arrangements are made by which the variations in the flow are equalised, and in this way the electrolytic process is applied to a clear tank effluent with a uniform rate of flow. A series of tests were made, and the conclusions arrived at were that, if the treatment is adapted to the character of the sewage, an effluent will be obtained stable in character and with the bacterial content reduced to a minimum. As a matter of fact, one of the thirty-seven tests for stability which are recorded only four gave 100 per cent stability, while the remainder vary from 2 per cent to 99 per cent, with an average of under 75 per cent. These results fall far short of what is required in a satisfactory effluent, and we should expect a chemical analysis to indicate the presence in these effluents of a large amount of organic matter which would render it unsuitable for discharge into a river. The cost of operation for electric power alone is calculated at about 70 per 1,000,000 gallons of a sewage the volume of which is about 55 gallons per person per twenty-four hours. If this is converted to a sewage of 30 gallons per person per day the cost would be at the rate of about 16s. 8d. per 1,000,000 gallons, and to this must be added the cost of supervision, sludge disposal, and renewals in connection with the electrodes in order to arrive at a correct estimate of the total cost of disposal by this method.

There is another point in connection with which further information would be useful, and that is the process which takes place in the sewage, due to the electrolytic action, by which the effluent is supposed to be rendered stable and at the same time practically sterile. The tests show that on the average 86 per cent of total bacteria and 97·7 per cent of acid-forming bacteria were removed by the process. The final effluent is discharged into a small creek, which is dry except during rainy periods, but no chemical analysis of the effluent is given, nor is any information supplied as to the condition of the creek except the general statement that there have been no complaints of any kind. So far as we can judge from the information available, the system appears to consist mainly of a process of sterilisation in which, by the use of electric current, the bulk of the bacteria are destroyed. If this is so the principle involved is the exact opposite of the biological method, where the bacteria, and particularly the nitrifying organisms, are cultivated to the utmost extent as in the case of percolating filters or slate beds, or the activated sludge process. All scientific investigation of recent years has shown that biological methods of sewage purification are natural methods, and to our mind any system in which the bacteria are almost wholly destroyed cannot well be a natural method. For this reason we must confess that the results recorded here fail to remove the scepticism with which we regard the electrolytic system. If the requirements of the case are limited to the removal of pathogenic bacteria, this could probably be effected with much less expense by a simple process of chlorination with bleaching powder, such as is already in use in a number of cases both for sewage and for water.

* * *

The Surveyors' Institution.

On Monday last the members of the Surveyors' Institution were privileged to hear a most interesting address from their new president, Mr. John Hanson who is, by the way, the first president of the institution to be chosen from the great county of Yorkshire. The address dealt entirely with the various effects of the war on the profession. These have been very far-reaching indeed, both as regards the number of men who have given up their ordinary business to join the Colours, and as regards fuel of employment and novel kinds of practice. The statistics which Mr. Hanson gave of the numbers of those connected with the institution who are serving in the naval and military forces of the Crown were really remarkable. Out of a total membership of about 5,000, many of whom have passed military age or are otherwise incapacitated from service, no fewer than 1,387 are with the Colours—a record of which the institution as a body may be justly proud. The personnel of the institution is also being affected by the comparatively small number of candidates who have presented themselves for examination since the outbreak of war. As an evidence of the patriotic spirit of the younger members of the profession this is entirely satisfactory, but, inasmuch as the institution is accustomed to look to its examinees for the maintenance of its membership, any circumstances tending to reduce their number must be regarded as adversely affecting its prosperity for the time being. Mr. Hanson was not inclined to be in the least pessimistic about this matter, however, and we agree with him in believing that a fuller prosperity than ever will be attained with the advent

of peace. In dealing with the effect of the war on employment, it was only natural that reference should have been made to the large reduction that has been effected in the Government valuation staff. Much sympathy will be felt with the request addressed to the Government to do what it can to reduce the inevitable hardship by insisting that competent men from the dismissed staff shall be looked upon as having a prior claim upon all vacancies in other departments which they have the necessary qualifications or ability to fill.

The second part of Mr. Hanson's address dealt with the main points in regard to which the war and the consequent special legislation have affected the work of surveyors. Perhaps the most important Act that has been passed from the surveyor's point of view is the Defence of the Realm Consolidation Act, by which authority is given to interfere with private property where consideration of public safety and the defence of the realm demand such action. The Act contains no provision for compensation, which cannot therefore be claimed as of right against the Crown. But this matter has not been overlooked, and a Royal Commission of Inquiry, dated March 31, 1915, has been issued appointing Mr. Henry Edward Duke, K.C., and Sir James Thomas Woodhouse, and Sir Matthew Yemmill Wallace to inquire and determine and to report what sums in cases not otherwise provided for ought in reason and fairness to be paid out of the public funds to applicants (not being subjects of any enemy State) who are resident or carrying on business in the United Kingdom, in respect of direct and substantial loss incurred and damage sustained by them by reason of interference with their property or business in the United Kingdom through the exercise by the Crown of its rights and duties in the defence of the realm. Thus it is to be noted compensation is not of right, but of grace, but there will be general confidence that individual property owners who may be affected will be fairly treated by this tribunal and the Crown. Exercise of the powers conferred by this Act has necessitated the calling in of surveyors throughout the country, and thus provided work at a time when it has been most opportune and acceptable to the profession.

* * *

Sewage Disposal by Incineration.

In spite of the spread of knowledge of sanitation cases still occur frequently in which it is apparent that it is the discharge from water-closets alone which is considered dangerous to health, and all other liquid wastes are treated as innocuous. The pipes and drains for conveying wastes from baths and lavatories, and even from sinks, are often constructed in the most perfunctory manner, and the wastes themselves allowed to flow into watercourses or rain-water drains, with the inevitable result that sooner or later a nuisance is created and a state of affairs detrimental to health arises. In other cases the absence of water-closets has been considered an advantage in the disposal of other domestic waste liquids, whereas, of course, it is actually a disadvantage. Some such ideas must exist, we fear, in the minds of those who advocate burning as a method of sewage disposal, and particularly in connection with the process so ably described in the paper, printed elsewhere, upon the "Destructive Distillation of Fæces." This paper, which was read at a recent meeting of the Institute of Sanitary Engineers, is a valuable contribution to the literature of sewage disposal, as it deals with a method which has been heard of on several occasions, but, so far as we are aware, has not been described so thoroughly as in the present case. It is undoubtedly an excellent process, and very efficient from a sanitary point of view so far as the disposal of the solids is concerned, but it will be very dangerous if the impression is allowed to exist that this system, in itself, forms a complete method of sewage disposal.

This system has been used in connection with at least one military camp, and is undoubtedly an efficient method of disposal for the contents of pails under the conservancy system of sanitation. *But* in addition to the expense of installing and running this distillation plant there is the high cost of cartage of the contents of the pails to the plant, and all this could be avoided by installing water-closets and connecting them to the drains, which are required in any case for the slop water. Further, the tanks and filters required for the treatment of the slop water would probably serve, without any extra outlay, for dealing with the additional sewage from the water-closets, as the latter would facilitate the bacterial action which is essential to the production of a satisfactory final effluent. This question was discussed in considerable detail in a paper on "Camp Sanitation" which was read by Prof. Kenwood at the Sanitary Congress at Brighton in September, and printed in these pages on September 10th. It is clear that this system of destructive distillation cannot deal with liquid wastes, and for this reason it cannot be considered as a complete method of sewage disposal. On the other hand, its efficiency in dealing with sewage solids is practically established, and there is ample scope for its application in the disposal of the large quantities of sewage sludge which are daily produced in the large number of sewage works all over the country.

* * *

Public Health Administration.

It is just forty years since the great Public Health Act of 1875, which may be described as the foundation of the fabric of modern sanitary law and administration in this country, was passed. Since that date, however, the science of preventive medicine has made such enormous strides, and the social aspect of public hygiene has been forced into such prominence, that at the present time our code of public health law is no longer comprised in a single Act, but is to be found in a large number of complex statutes. Moreover, the several authorities that at present exist in England and Wales for local government purposes are all the creatures of modern Acts of the Legislature. Thus, county councils were brought into being by the operation of the Local Government Act, 1888, by which the county boroughs were also constituted; and the government of the non-county boroughs was profoundly affected by the passing of the Municipal Corporations Act, 1882. Both county boroughs and boroughs are urban sanitary districts for the purposes of the Public Health Act, 1875, which Act also brought into being urban and rural sanitary districts, other than boroughs. The name of the latter was changed to urban districts or rural districts by the Local Government Act, 1894, by which were established the urban district councils and rural district councils of the present day. This brief survey is sufficient to show that the student of modern public health administration is faced with a subject of great complexity. Unfortunately the text-books which have hitherto been written have nearly all dealt with the matter either from a purely legal or a purely practical point of view. Now, however, a book* has been published from the pen of Mr. B. G. Bannington, the inspector of nuisances for the County Borough of West Ham, which treats the public health department as an administrative unit of the system of local government. He has done his work well, and we cordially recommend it to the notice of health officials who wish to have an intelligent knowledge of the gigantic national

* "English Public Health Administration," by B. G. Bannington. London: P. S. King & Son, Ltd. Price 7s. 6d. nett.

system of which they form a part. Not the least interesting chapter of a book that holds the attention throughout is the final one on the need for reform. This is suggested chiefly in the direction of a codification and simplification of public health law. The establishment of a central department, under which, with a responsible Minister in Cabinet rank, is another possible reform, which, however, by reasons so important as the new result of unavoidable public health administration is undoubtedly more efficient than it was, there are still many imperfections in the machine. In making such an able and impartial survey the Commission has rendered a public service.

* * *

War Economies. Recent discussions on the possibility of effecting economies in the expenditure of local authorities have tended to bring out more and more clearly the best line of attack. It is in detail rather than in the paring of large amounts in regard to single items that attention should be paid. This point was once more emphasised [illegible] in the excellent paper on the subject which was read last Saturday before the Lower Thames Valley District Surveyors' Association by Mr. Edward Willis, the engineer and surveyor to the Chigwell Urban District Council. In considering possible economies in this detailed manner it is inevitable that chief attention should be directed to the engineer's department—the great spending department of every local authority. But, as Mr. Willis pointed out, if the engineer and surveyor realises the absolute necessity at the present time of reducing local expenditure—as, indeed, who does not?—and is allowed a fairly free hand in the matter, material savings should result. There is a tendency in some quarters for members of local authorities themselves to insist upon certain forms of so-called economy against the advice of the engineer. This practice is greatly to be deprecated, inasmuch as it is quite impossible to judge of the propriety of such economies without technical knowledge. In the case of highway maintenance, for example, there always is the possibility that an immediate and temporary saving may be more than counterbalanced by an ultimate and permanent loss. Moreover, in the case of main roads, we strongly agree with Mr. Willis that no economies should be exercised in regard to actual repair when this is needed, for at the present time it is a matter of national importance that these highways should be kept in a thoroughly efficient condition. As an example of saving by attention to detail, Mr. Willis cited the rearrangement he has effected in regard to the scavenging of the district for which he is responsible, the effect of the alteration being to save the wages of five men, together with the [illegible] per annum. His paper is exceedingly suggestive as to possible economies in detail in many branches of administration, and we are confident that if his suggestions, so far as applicable, were carried out in every district, the total [illegible] would be most substantial.

* * *

River Conditions in Lancashire. That the [illegible] of river [illegible] should be increased, [illegible] as a result of war conditions, would indeed be a deplorable thing, but there is every reason to believe that nothing of the kind has happened. The complaint was made recently by Alderman T. Rothwell, a member of the Mersey and Irwell Joint Committee, in his annual report to the Bury Town Council on the work of the committee. He stated as to the purity of the rivers that they had been even to ten years, and he ascribes this to the difficulty in obtaining chemicals. "The base of the chemicals used in the purification of sewage and manufacturers' waste," he proceeds to say, "is also the base of explosives, and naturally the bulk has gone to what is at present the most vital side." Precisely what authority Alderman Rothwell has for his alarmist asseverations we do not pretend to know. He occupies a responsible position as a member of the Mersey and Irwell Joint Committee, and his report has naturally attracted attention. Inquiries that have been made would seem to prove that there are few if any grounds for disquietude with respect to the condition of the rivers and streams in the district. It is agreed that, chiefly owing to the prolonged drought, the waters do not present a favourable appearance. It is also admitted that a shortage of labour has affected the condition of the tanks, but on the other hand it is stated that the chemicals used for purification purposes form only a very small proportion of those used by the War Department. To draw from the conditions prevailing a general conclusion that the purity of the rivers has gone back from seven to ten years is, happily, quite erroneous. The recent abundant rainfall will probably have the desired effect of bringing back the rivers to a normal condition.

* * *

Salcombe Surveyorship. In the interests of the ten candidates who applied for the appointment of acting surveyor and inspector of nuisances to the Urban District Council of Salcombe, Devon, we cannot refrain from entering a mild protest against the manner in which the appointment is made. Public advertisements were issued, and in reply ten applications were received. In addition to these, Mr. T. W. Latham, a resident in the neighbouring district of Kingsbridge, wrote offering his services in the event of the council experiencing any difficulty in obtaining suitable applications, although he wished it clearly to be understood that he did not wish to stand in the way of any person who applied for the office. It goes without saying that no complaint is made of this well-intentioned offer, but we do complain of the fact that the council appointed Mr. Latham in spite of the fact that there were ten applications before them. It may be said that, having regard to the smallness of the salary and the temporary nature of the appointment, the matter is one of trivial consequence. This may be so from the point of view of the public, particularly as we understand that Mr. Latham is unexceptionable from the point of view of efficiency, but to the candidates concerned the matter is of great importance, inasmuch as they were put to the trouble and inconvenience of preparing applications and collecting testimonials—trouble and inconvenience which might have been avoided by refraining from advertising until it was quite certain that the appointment would be made from among the suitable applicants.

Damage to Roads by Military Traffic.—The Chancellor of the Exchequer was asked in the House of Commons on Tuesday if he was aware that damage was being done to the roads near military camps by traction vehicles conveying war outfit, and, if no further grants were made to local authorities by the Road Board as was proposed by Clause 41 of the Finance (No. 3) Bill, whether he would take steps to prevent the expense of repairing the damage from falling on the ratepayers. Replying, Mr. McKenna said that cases of damage done by military traffic to roads in the neighbourhood of camps were considered by the War Office, and steps had been taken to secure that proper contributions were made to the cost of repairs out of Army funds. Clause 41 of the Finance Bill would have no effect whatever on existing practice in that respect. Asked whether the undertaking of a proper proportion of expenditure by the War Office extended to the increased user of roads throughout the country owing to military operations, Mr. McKenna said he thought the question should be addressed to the War Office.

Huddersfield War Hospital.

TOWN'S UNIQUE GIFT TO THE MILITARY AUTHORITIES.

When first the War Office contemplated taking over certain Huddersfield schools suitable for conversion into military hospitals the proposal was heartily responded to by the corporation and the managers of private schools, with the result that General W. W. Kenny, Northern Command, York, along with members of the staff, visited Huddersfield and examined several of the principal schools in the borough. Greenhead High School for Girls and Church schools recently erected at Marsh were eventually selected. On hearing of this decision the corporation, as well as the managers of the Marsh school, placed the buildings at the disposal of the War Department.

Upon further consideration of the alterations necessary to convert these modern institutions erected for educational purposes into suitable hospitals for the wounded, and their reinstatement to the original condition, it was felt that the cost, as well as the inconvenience which the proposal involved, did not warrant the expenditure required to adapt the schools for hospital purposes—the fact being that the buildings were inadequate.

On realising the decision arrived at, and notwithstanding the enormous amount of hard work already done in many ways connected with the war, as well as a large amount of funds raised for the relief of our wounded as well as those of our Allies, the originators of the scheme, with his Worship the Mayor, heartily joined in the movement of providing an up-to-date hospital, fully equipped, with the result that a sufficient sum was at once raised to enable the hospital scheme to be put forward with all possible speed.

A committee was formed, and with the consent of the town council the services of the borough engineer, Mr. K. F. Campbell, M.INST.C.E., M.I.E.E., who has had a large experience in the construction of hospitals, were requisitioned by the committee, and he prepared the hospital scheme in all its details.

The site selected—a most excellent one for the purpose—was that at Royds Hall, and upon the corporation being asked for their approval, their sanction was cordially and unanimously given.

Before submitting the scheme to the War Office it was considered desirable to call in the services of Prof. G. Sims Woodhead, who has charge of the Pathological Laboratory, New Medical Schools, Cambridge, and who has taken such a leading part in connection with most of the hospitals erected since the war commenced. Prof. Sims Woodhead viewed the site, and approved of the plans prepared. Subsequently the plans were submitted to the War Department and to the headquarters of the Northern Command, who also approved of them, and within a fortnight of the committee giving instructions for the work to proceed tenders were accepted and the contractors had commenced operations on the ground.

The principal building contractors are Messrs. John Radcliffe & Sons, builders, St. John's-road, Huddersfield, and Messrs. H. Hollingworth & Sons, joiners, Mold-green; but the whole building contract was let to the former firm.

A large proportion of the work connected with the building and equipment of the hospital has been carried out by local firms, and everyone connected with the scheme is to be congratulated upon the speed and satisfactory manner in which the work has proceeded, especially when it is borne in mind that a period of only about two months has elapsed between the commencement of building operations and handing over to the War Department the hospital fully equipped ready for occupation of the wounded.

At the conclusion of the war the War Department will return the buildings and equipment to the Hospital Committee.

In addition to the erection of the hospital buildings the residence known as "Royds Hall," situate in close proximity, has been converted into nurses' quarters.

The total estimated cost of erecting the hospital buildings, furniture and equipment, is £22,500, and the whole of the work has been supervised by the engineer, Mr. K. F. Campbell.

The hospital has been designed to accommodate

Huddersfield War Hospital.

600 patients, with the requisite accommodation for the administrative staff.

The following is a description of the hospital buildings, which consist of ten wards, together with administration block, kitchen block, operation block, R.A.M.C. block, pack store, recreation block, mortuary, hospital supply block, disinfecting block, with boiler-house adjoining.

All the buildings are constructed with framing in timber on brick foundations, asbestos walls impervious to weather, with boarded roofing covered with Ruberoid—a bituminous weatherproof sheeting which is largely fire-resisting.

The heating and sanitary provisions are on the most improved system, and they have to be operated with care and discretion by a responsible officer. All the rooms are lighted with electricity obtained from the corporation mains.

The whole of the wards face almost due south, and the general arrangement of the various buildings is similar to the hospital recently erected at Cambridge for "open-air treatment," the front of all wards being entirely open and fitted with canvas blinds of special design which can be used as an awning for protection against the sun, or drawn down vertically to enclose the wards during inclement weather.

The hospital is arranged on the following lines:—

There is about ½ mile of wards split up into five blocks of buildings running east and west. Each block faces south, and is divided up into three portions. The blocks vary in length from 310 ft. to 395 ft. They are all 21 ft. wide, and 12 ft. 9 in. to the ridge of the roof. In each block is a western and an eastern ward. All the wards on the east side have accommodation for fifty beds each, and the

[illegible] sixty-eight, and sixty-eight beds respectively. In connection with seven of the larger wards, and situate [illegible] At the end of each ward are two private wards (for use in such cases as cannot be put into open wards), ward kitchen, pantry and linen stores, three bath-rooms, and men's lavatories.

Separate inclined covered ways, 5 ft. in width, give access to the various wards, and between these corridors are situate sluice departments for each ward and water-closets for the patients. Common to both wards, these covered ways lead direct to the kitchen block, and, in consequence of the fall of the ground and the various blocks being on different levels, all covered ways connecting the various blocks are in-[illegible] there are no steps at all.

STRUCTURAL DETAILS.

The wards are enclosed on the east, west and north sides, but the south side is entirely open to sun and air except for a low fence, 18 in. in height, above the floor level to the front of the same, and as a precaution against rain, &c., blinds are provided which can be let down as an awning for protection against the sun or drawn down vertically to enclose the wards, if necessary, in very bad weather, and also to keep out the rain.

Within each ward are two parallel rows of beds. During very bad weather or a southern gale the front beds can be drawn back, the passage between the beds being lessened or entirely done away with. Wooden lagged paths connect all buildings.

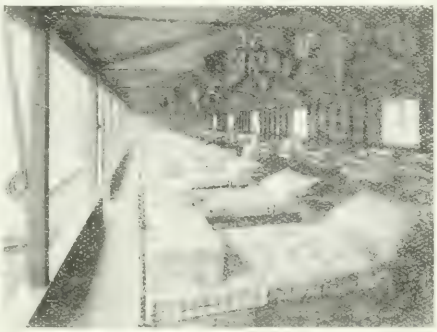
KITCHEN BLOCK.

This block is 93 ft. in length and 21 ft. in width. In cross-section it is practically the same height as the wards.

The whole of the cooking is carried out under improved conditions by means of ranges and other appliances approved by the War Office. Large boilers are used for cooking soups and vegetables. There are heated tables for carving, apparatus for warming the plates, and large roasting ovens. There is a scullery adjoining the kitchen fitted up with all the necessary sinks, &c., and ample storeroom for milk, bread, meat, vegetables, groceries, &c., and a special room for the cook, and the necessary coal and coke stores, and lavatory accommodation for the staff. The covered ways from the various wards lead direct to the kitchen block.

ADMINISTRATIVE BLOCK.

The administrative block is situate near to the entrance. It is 161 ft. long by 21 ft. wide, and contains receiving-room, registrar and clerk's office, [illegible] for the other in charge, doctor's room



Huddersfield War Hospital: Internal View of Ward Equipped.

Huddersfield War Hospital: Plan.

waiting-room, clinical laboratory, matron's sitting-room and bedroom, officers' mess, with all the necessary baths, lavatories, &c., complete.

OPERATION BLOCK.

The operation block is situate in close proximity to the wards, and is connected by a covered way 5 ft wide. It is 50 ft. long by 28 ft. wide, somewhat higher than the wards, and contains X-ray and Rontgen apparatus room, anæsthetic room, operating room, sterilising room, preparation room, cloak-room, surgical store, and a room for photo-developing purposes. The walls and ceilings are finished in fibrous plaster; all angles are rounded, and all walls and ceilings are distempered. The windows are designed to give free access to the fresh air when the room is not in use. The operating room, anæsthetic and Rontgen ray rooms are lighted from above as well as from the north, and the whole is fitted with the very latest and most up-to-date surgical appliances.

HOSPITAL SUPPLY BLOCK.

The hospital supply block is situate at the east end of the wards, and is 100 ft. long by 28 ft. wide, and ample accommodation is provided for the storage of clean linen and utensils. All the rooms are heated by stoves and finished in a suitable manner.

R.A.M.C. QUARTERS.

The quarters of the R.A.M.C. are situate on the north side of the carriage drive, near the entrance, opposite the administrative block, in a building 160 ft. long by 21 ft. wide, and comprise dining and day rooms, sleeping quarters with bunk accommodation for sixty men, two bath-rooms, store-room, water-closets, and lavatory accommodation.

PACK STORE.

The pack store is situate near the R.A.M.C. quarters. The building is 50 ft. long by 21 ft. wide, and is fitted up with racks [illegible] into compartments numbered to receive the packs and equipment of the wounded who arrive at the hospital. It is heated by a stove placed in the centre.

RECREATION ROOM.

The recreation room abuts upon the carriage drive to the hall. It is 80 ft. long by 28 ft. wide, and contains a large room, 64 ft. by 28 ft., two small rooms for N.C.O.'s, and a small stage for impromptu concerts or entertainment, in which event the N.C.O.'s rooms serve as retiring rooms, the large hall being fitted up with tables, chairs, &c., and heated by means of stoves.

MORTUARY.

The mortuary is situate at the north end of the site, and is approached from the carriage drive. It is 68 ft. long by 28 ft. wide, and contains post-mortem room, body chamber and viewing room, and is fitted up with all the necessary appliances.

The whole of the buildings throughout are lighted by electricity. The heating is on the low-pressure hot-water system, and a separate system supplies hot water into all the several buildings.

A telephone system has been installed with a central exchange situate in a small office near the administration block, through which communication can be established with all the several departments.

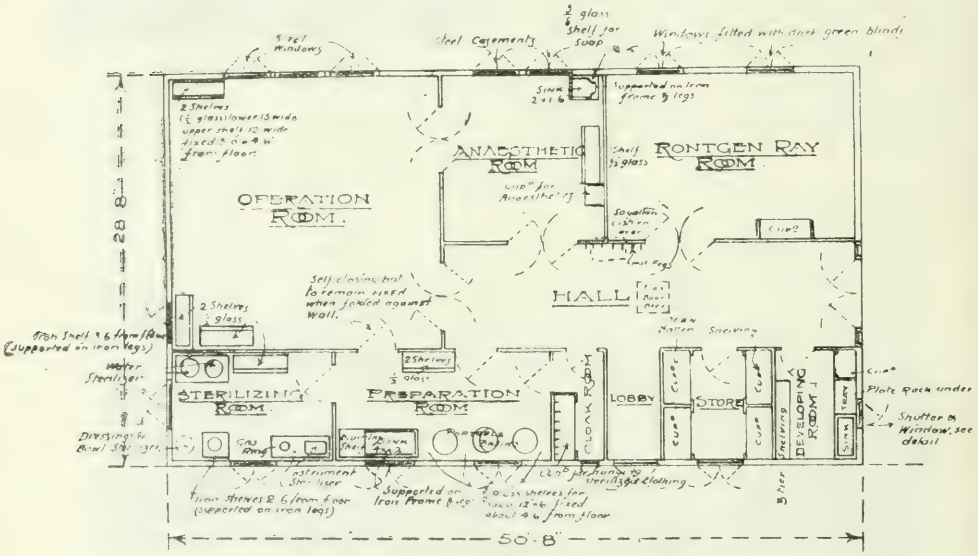
ROYDS HALL.

The hall, until recently used as a home for Belgian refugees, has been adopted to provide accommodation for the nursing staff at the hospital, numbering, for the present, about forty-five nurses.

Several rooms have been temporarily divided into cubicles to provide the necessary sleeping accommodation, so that practically each nurse will have a separate room in addition to the use of the large lounge fitted up under conditions generally acceptable to War Office regulations.

The new hospital was opened by the Mayoress of Huddersfield on the 4th ult., and formally handed over to Surgeon-General W. W. Kenny, deputy director of medical services in the Northern Command, for the use of the War Office during the period of the war.

In the course of the proceedings Mr. J. H. Kaye, J.P., representing the subscribers, said their grateful thanks were due to Mr. Campbell, the borough engineer, who gratuitously supplied all the plans and specifications, and arranged all the contracts for the carrying out of this work. They all knew that the only reward Mr. Campbell sought was the knowledge that they were all satisfied with the result of his arduous labours, and that satisfaction he (the speaker) knew he could, in their name, give to him.



HUDDERSFIELD WAR HOSPITAL: PLAN OF OPERATING THEATRE.

Surgeon-General Kenny, who followed, referred to the celerity with which everything had been done, and observed that he had received the greatest assistance from Mr. Campbell.

HOUSING AT TILBURY.

LARGE SCHEME IN PREPARATION.

In view of the great pressure of work in Tilbury, and of the increasing demand for houses for the housing of transport workers and others, the Tilbury Urban District Council have decided to adopt an extended and continuous housing policy. At a special meeting on the 8th inst. the council appointed Messrs. Pepler & Allen, F.S.I., F.R.I.B.A., of Howard House, Arundel-street, Strand, as consulting architects, and Messrs. F. J. Winter, M.S.A., of 2 Heygate-avenue, Southend-on-Sea, and W. J. Wadman, of 71 Jerningham-road, New Cross, S.E., as acting architect, to act in conjunction with Mr. S. A. Hill-Willis, ASSOC.M. INST.C.E.I., engineer and surveyor to the council, in preparing a scheme for the erection of further houses up to the number of 500, in addition to the 150 now in course of erection, and arrangements are being made for the town planning of the whole district with a view to its development on healthy and progressive lines.

The houses being mainly required for transport workers, whose services are essential in connection with the war, it is probable that a Government grant will be applied for towards the cost of construction, such as has been granted in other districts where a large number of war workers are employed.

Municipal Economy in War-Time.*

By EDWARD WILLIS, ASSOC.M.INST.C.E., F.S.I., &c., Engineer and Surveyor to the Chiswick Urban District Council.

[illegible] economy, combined with efficiency, is one that is more or less daily in the mind of the average municipal engineer and surveyor, but it has been more than ever impressed upon him during the last few months, since the incidence of taxation is already so great, and will necessarily be much greater, and the ordinary ratepayer will have an opportunity of criticising or obtaining any reduction thereon, that he will make every effort to force [illegible] authorities to reduce local expenditure to the lowest possible amount.

In many districts, where experience in the past has proved that the best article at a fair price is nearly always true economy, there may be opportunities of showing a more or less appreciable reduction in the local rates, since an essential point of good administration, which the foregoing principle necessitates, is to retain a working balance for emergencies, and it may now become possible to encroach upon this, and even to rely to some extent upon the lasting properties of good materials for a longer period than ordinary economical administration usually risks.

At the same time there are numerous local authorities where opportunity, [illegible] exists to see that no unnecessary work [illegible] and I am sure such [illegible] further economies are made to any large extent, maladministration of the district will result.

There are many ways in which economy may be effected other than by the engineer, such as the elimination of Parliamentary work in Private Bill legislation, the utilisation of waste land where used for old slop-shoot in the past, the more general employment of women throughout all departments, the collection of Poor and District rates, and even taxes upon one demand note, and the issue of one instead of two or three notices, the amalgamation of adjoining districts, thus reducing the number of local authorities with their consequential administrative expenditure, and temporary cessation of all elections, with heavy expenditure incidental to these. But all of these suggestions involve questions of general policy more than administrative ability, and I therefore propose to make no further mention of them.

The engineer and surveyor's department is essentially the spending department under any local authority, since although, under some methods of accounting, the accountant's or treasurer's department shows [illegible] expenditure, the proper portion of this [illegible] being incurred by work necessarily carried out by the surveyor as the chief constructive officer, which had necessitated loans being obtained, and the repayment of such loans with the corresponding interest, is a payment made through the clerk, accountant or treasurer. These, however, are predetermined payments, and, of course, should incur only nominal labour, since sinking fund and interest payments remain a fixed or decreasing charge until the expiration of the loan.

Before actually describing more in detail some suggestions for economy, it might be desirable to point out how much wiser, in the best interests of the district, it is to provide for equal payments of capital only in lieu of equal payments of interest and sinking fund combined, since by the former method, although the strain on the finances is somewhat heavy at the start, the reduction in interest is so appreciable that in a few years the total charges are much lower than under the alternative system of equal annual payments of both capital and interest.

HIGHWAYS.

In the engineer and surveyor's department, with which we are principally concerned, probably highways will become [illegible] most of the paring-down that must be anticipated during the next two or three years.

The normal expenditure on roads can be roughly classified into three heads, viz.:

(1) Main roads;
(2) Subsidised roads; and
(3) District or "other roads" (including subsidised road footpaths).

In the case of main roads, I am strongly of opinion no economies should be exercised in regard to actual repair when this is needed, since it is to the advantage of the nation that the upkeep and maintenance of its natural highways should always be most efficient.

It is possible a slight reduction in watering can be made, minor reductions in scavenging, and in some cases patching can be resorted to for a longer period before recoating; but I would particularly urge that general economies should not be exercised to the detriment of the road surfaces, especially when it is borne in mind that local expenditure is more than balanced by national and county payments.

The footpaths and public improvements, such as widenings of main roads, might, however, form a possible opportunity for appreciable economies, but these will be largely governed by the condition of such paths prior to the commencement of the war.

Subsidised roads must be considered on somewhat similar lines to the last mentioned as regards the roadway, except that in the case of the A Class in Middlesex 50 per cent. and in the case of the B Class 25 per cent of the audited cost only is paid by the county council. The effect, then, of paring down material upon such roads would be partly appreciated in each district, as well as in the county rate; but at the same time, if subject to heavy traffic, such paring down must be undertaken with the greatest care.

In the case of macadam main and subsidised roads it is usually found that no satisfactory foundation exists, and should a bad winter be experienced, there is a serious risk of permanent damage to the structure if reasonable and efficient maintenance is not consistently carried on.

I, personally, have tried to effect economies in watering, scavenging and rearranging, and to do so without loss of efficiency I have maintained tar-painting and finishing with granite chippings on each of the subsidised roads in my own district.

Footpaths, however, have received but little attention beyond the repair of every known serious defect which might be considered dangerous, and I think that is the general line we must adopt during these anxious times.

In most districts, "other roads" bear the brunt of any paring-down processes from year to year, and conversely any windfall that may by any exceptional chance reach the hands of the unfortunate surveyor is used to make good the enforced omissions from previous estimates.

There is, undoubtedly, an opportunity in most districts for a variable expenditure under this heading.

Often even a somewhat important district road may be in a comparatively bad state of repair, and yet reasonable efficiency may in war-time be maintained by extensive patching or partial scarifying and recoating; but in affluent times the probability is such road would, to obtain the maximum of efficiency, wisely be scarified, shaped and coated throughout. This is one instance where a considerable saving may be effected.

I do not advocate in any shape or form a reduction in tar-painting, especially on water-bound macadam roads, where it is undoubtedly needed. My experience has hitherto proved that a good water-bound road on a sound foundation, properly tar-dressed and gritted with good granite chippings, may last for a considerable period without even any repairs by patching, except, of course, in the case of trenches.

Before leaving the repair of highways, I am of opinion a saving can often be effected by small potholes and depressions being made good with tarred granite or slag macadam, and as this custom has proved economical for some years past, I am adopting it more than ever during the present war-time to avoid recoating.

SCAVENGING.

It is a moot point as to whether material economies in scavenging can be effected without damaging the amenities of a district.

Prior to the war I had effected some savings in scavenging, partly as the result of tarred roads and partly by a rearrangement of method.

It had been the custom in my district to have one-man beats throughout, and each man was supposed to scavenge certain special roads daily, and others less used twice or thrice weekly. By the new arrange-

* Paper read at a meeting of the Lower Thames Valley District Surveyors' Association held at Chiswick Town Hall on Saturday last.

[illegible] each, composed of four men, making one man responsible for each gang, and giving him a shilling a week extra while so engaged, did practically the whole area except three or four roads. This effected a small economy in manual labour, but it enabled me to reduce the cartage by one horse per day, which at the present high rate was a material saving.

Owing to the necessity of further reductions, to make up for other losses incidental to the war, and the considerable increase in the price of materials, I have made further modifications, but in so doing I pointed out to the council that it would be impossible to give quite such efficient results as regards appearance or amenities.

The method adopted is to split up my five gangs into two of five men each, discharging five men (who were all engaged temporarily in place of men who had gone to the Front), and working the remainder of the district by one-man beats.

The effect of this further alteration has been not only to save the wages of five men, but also to save another horse and van per diem. This saving has been consistently maintained, but, of course, I am not prepared to say it will be possible to continue under abnormal weather conditions, and whereas in previous years while the leaves were falling I have increased the number of sweepers temporarily, this year these have also been dispensed with.

GULLY WORK.

No alteration has yet been made in this department, but I anticipate further saving on the two gully carts usually employed by the use of a steam vacuum gully emptier, attached to an ordinary steam motor-wagon, this being the first emptier of its type made, and I hope to have this working in the course of the next two or three weeks.

WATERING.

It is probable that every municipal engineer throughout the country has economised in this particular department during the past summer. It has, of course, been effected at the expense of the amenities to some extent, but in actual practice I do not think there has been any damage to health in my district, whatever may have happened elsewhere, the death-rate being still remarkably low.

I hope to effect further economies under this department by the use of motor water vans next summer.

PUBLIC LIGHTING.

The Government Regulations in respect of this matter have been so plentiful that surveyors have been exercised in their minds as to how efficiently to meet the wishes of residents and police.

After the first Order every alternate lamp was extinguished, except at the corner of side or intersecting streets, but since the second Order, in Chiswick all straight roads have practically every lamp extinguished, except the end ones or those opposite intersecting roads, and this illumination has hitherto been very poor, but sufficient.

The effect of the reduced lighting has not, however, made quite a corresponding reduction in expenditure, since there is always a certain amount of maintenance, and it would be manifestly unfair for the gas company (if they maintain) to lose the whole of their allowance for such maintenance.

Under these circumstances, the arrangement adopted in Chiswick, and probably in many other districts, is to deduct the total cost of gas not consumed (in Chiswick upwards of 4,000 hours), and one-half maintenance charges, which are 8s. for the ordinary 3½ cub. ft. lamp.

In my case the ordinary lighting bill is approximately £2,600, and this has been reduced to nearly £2,000.

The lighting of extinguished lamps on occasions of sudden fog is now being considered by numerous surveyors. I, personally, foresee considerable trouble in the matter, and although I am trying to make some provision for this, I do not think it will be an entire success.

(To be concluded.)

Board of Trade and Provisional Orders.—The Board of Trade give notice to parties contemplating the promotion of Provisional Orders in respect of electric lighting, gas and water, piers and harbours, and tramways, that for the duration of the war they will not be prepared to entertain such applications except in cases in which they are satisfied that extreme urgency exists.

ROAD BOARD GRANTS.

In the course of the proceedings in Committee on the Finance Bill in the House of Commons on Tuesday, on Clause 41, which deals with the suspension of the road improvement grant, Mr. Molteno (Dumfriesshire) moved an amendment the object of which would provide that instead of taking away the whole of the grant from the Road Board a reduced grant should be given. Without the board the main thoroughfares of the country would not have stood the strain of the military requirements during the past twelve months. Owing to the congested state of the railways it was absolutely necessary to maintain the roads in a good state of repair; otherwise the ordinary life of the country would be paralysed.

The Chancellor of the Exchequer said the amendment was wholly irrelevant to the clause. The Road Board had £3,000,000 in hand, and the existing funds would last for ten years. Therefore there was no necessity to pay sums out of the Consolidated Fund which were urgently needed in other directions.

The amendment was negatived.

CORRESPONDENCE.

Εἰς ἀνὴρ οὐ παιθ' ὁρᾶ
(One man does not see everything.)
—Euripides.

LUMINOUS PAINT.

To the Editor of The Surveyor.

Sir,—With reference to the inquiry in last week's issue of The Surveyor *re* the above, I have recently applied luminous paint to lamp-posts in this borough, for the purpose of indicating their proximity in the dark, and find it quite satisfactory.

The paint can be procured from Mr. W. C. Horne, St. Katherines, London-road, North Cheam, Surrey.—Yours, &c.,

Thos. R. Swales,
Borough Surveyor.

Maldon.
November 6, 1915.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Matlock U.D.C. (November 10th. Mr. H. S. Bidwell).—This was an inquiry with respect to the request of the council for further powers to raise loans to continue and complete the sewerage scheme. By order of the Treasury the power to borrow a further £12,000 to go on with the scheme had been deferred pending a visit of an engineer to the works. —It was explained that £45,000 was granted for the work, and £32,000 had been expended. A sum of £24,000 had been asked for, and the Local Government Board granted £12,000. If the scheme were stopped now it would mean losses all round. In reply to the inspector, the clerk (Mr. R. Taylor) said they had not asked the other councils to pay.

APPLICATIONS FOR LOANS.

Leiston U.D.C.—£1,000 for a new cemetery and chapel.

Penzance T.C.—£400, supplemental loan in respect of the erection of a school.

Stoke-on-Trent T.C.—£2,000 for distributing mains.

LOANS SANCTIONED.

Derby T.C.—£1,927 for electric mains, and £2,043 for electric motors.

Kanturk R.D.C.—£1,400 for the erection of cottages.

Sunderland R.D.C.—£7,000 for repairing the sea wall at Whitburn.

LOANS REFUSED.

Leyton U.D.C.—£18,158 for electricity extensions.

Romford U.D.C.—£540 for sewerage works.

FORTHCOMING INQUIRIES.

NOVEMBER.	£
16.—**Battle.** For works of sewage disposal (Mr. P. M. Crosthwaite)	950
17. **Llantarnam.** For works of sewerage (Mr. W. O. E. Meade-King)	600
17.—**Whitstable.** For works of sewage disposal (Mr. P. M. Crosthwaite) ...	3,726

Law Notes.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only, and addressed to "Law Editor, at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter X, combinations such as* X.Y.Z., *and words such as* "engineer" *and* "surveyor," *should never be used.*

SANITARY SURVEYOR'S DUTIES.—"T." writes: I occupy the post of "district surveyor" to a rural district council, and my duties consist of the maintenance of all roads, water supplies and sewers in the district. A dispute has arisen between the inspector of nuisances and myself in reference to the question of the superintending of house connections to sewers. As the council's "surveyor," I maintain that I am the person responsible for seeing that all drains connecting to the sewers under my control are properly laid, and that I am entitled to examine every drain before it is covered over. The inspector of nuisances maintains that, as house drains are not public sewers under the control of the council, I have no jurisdiction in the matter, and that he has full powers to have the drains laid just as he chooses and covered over without examination or approval of the surveyor. In my opinion the Public Health Act, 1875, and the 1907 Act clearly places the responsibility for this work on the shoulders of the surveyor. The clerk to the council, who is a well-known solicitor, agrees with my view, but in his desire to appear quite impartial he declines to adjudicate on the matter. The question has now been referred to a sub-committee of the council—the members of which cannot profess to know much about sanitary law. I shall esteem it a great favour if you will allow me to ask those of your readers who are sanitary surveyors, but not inspectors, to furnish me through your office with their views, and, wherever possible, with a printed list of their duties as sanitary surveyors. This is a matter of vital importance to surveyors generally, and should the decision of the council go against me I shall be glad to know what you would advise me to do in the matter.

The duties referred to in this letter are not specifically mentioned in the list of duties of inspectors of nuisances prescribed by the regulations of the Local Government Board by their General Order (Rural Sanitary Authorities) of March 23, 1910. The regulations provide, however, that, "in matters not specifically provided for in this Order, he shall observe and execute all the lawful orders and directions of the sanitary authority." The Public Health Act, 1875, provides by sec. 21 that a person making a connection to a sewer is to be "subject to the control of any person who may be appointed by the local authority to superintend the making of such communications." It would appear, therefore, that the matter is one for the discretion of the council, although it is obviously convenient that the officer having control of the sewers should also have the control of the making of connections thereto—an opinion which is strengthened by a reference to sec. 38 of the Public Health Acts (Amendment) Act, 1907, and the duty cast upon the surveyor thereby.

DITCH FOULED BY SEWAGE. INJURY TO CATTLE.—"G. D." writes: A village sewer discharges into a ditch between two fields. This ditch is from 4 ft. to 5 ft. deep, and is proved to be dangerous to cattle by the fact that a colt belonging to the occupier of the fields got into the ditch and sustained serious injury. The sewer was originally constructed for a street surface-water drain many years ago, but has become a sewer by reason of drains from three houses being connected to it. The sanitary authority have also previously cleansed out the ditch. (*a*) Who is responsible for keeping the ditch clean, so as to prevent injury to cattle? (*b*) Can the owner of colt claim compensation for loss of colt from the rural district council?

In our opinion the answers to these questions depend upon whether or no the ditch is a "sewer" within the meaning of the Public Health Act, 1875. Although a natural stream cannot usually be said to be a "sewer," it may become one by long user, and whether it does so is a question of degree (*Newcastle-upon-Tyne Corporation* v. *Houseman*, 1899, 63 J.P., 85), but we assume that the ditch now under discussion is not a "sewer." An important distinction has been drawn between cases where a nuisance of this kind has been created or increased by the acts of the local authority, and where it exists independently of their acts, though they may have neglected to provide a proper system of sewerage. The whole question is discussed in *Harrington (Earl of)* v. *Derby Corporation*, 1905, 1 Ch., 205. In the former class of cases the local authority will be liable in an action for an injunction and damages, whereas in the latter the only remedy open to an aggrieved party is a complaint to the Local Government Board under sec. 299. In the case just referred to, the sewage of Derby had for many years been discharged into the river Derwent by (1) old sewers, into which householders of Derby had for more than twenty years discharged their sewage; (2) sewers inherited by the corporation from their predecessors, into which householders had by virtue of their statutory rights made connections; (3) sewers laid by the corporation themselves; (4) additional sewage arising from the conversion of privies into water-closets, under directions given by the corporation. It was held (*inter alia*) that no action would lie against the corporation for non-feasance or neglect of duty under the Public Health Acts, the plaintiff's remedy in that respect being by complaint to the Local Government Board under sec. 299 of the Public Health Act, 1875; also that an action would lie against the defendants for damage caused by acts which they had done themselves.

HIGHWAY REPAIR.—"E. W." writes: A gas company opens a highway under sec. 6 of the Gasworks Clauses Act, and (*a*) does not leave the surface in a satisfactory state; (*b*) does not maintain the surface in a satisfactory state. (1) Is a local authority empowered by sec. 12 to make good without first giving notice to the company concerned? (2) Assume the answer to be in the negative, and suppose the same condition as stated in (*a*) and (*b*), where the requisite notice as per sec. 8 has not been given, is a notice then necessary? (3) If the authority decide to send a notice under sec. 11, should not proceedings be taken for the default indicated by the notice? (4) If a notice is sent under sec. 12, (*a*) should it be in the form of an intimation of the authority's intention to repair, or (*b*) should it give a certain time to the company to repair it, and (*c*) how much notice?

In our opinion the answers to these questions are as follows: (1) We think yes; although the contrary view is arguable. (2) We think not. The absence of notice by the company under sec. 8 is another offence under sec. 11. (3) The notice is merely a condition precedent to the recovery of the daily penalty. (4) In view of our answer to (1), this does not arise.

HEDGES OBSTRUCTING DRIFTWAY.—"J. K. D." writes: The hedges adjoining a driftway or droveway which connects two villages have grown to such an extent that it is dangerous to drive over the droveway to get to the adjoining land. The rural council (in Somerset) have not taken over this droveway, but have been requested by the owner of property situated therein to force the owners of the adjoining fields to cut the hedges. I should be obliged if you would inform me whether the rural council have power to deal with the matter, and, if not, whether the aggrieved party can take action.

By sec. 2 of the Highway Act Amendment Act, 1885 (which only extends to the counties of Wilts, Dorset, Somerset, Devon, and Cornwall), "if in the opinion of any highway board . . . any obstruction is caused in any highway by any hedge . . . adjoining such highway, it shall be lawful for such board at any time to cut, prune, or pare the said hedge . . . provided that the consent of the owner and occupier of the premises on which the hedge . . . is situated has been first obtained." These powers may, we think, be exercised by a rural district council in the counties mentioned, if such council have succeeded to a highway board. We are aware of no other statutory provision applicable to a driftway, as distinguished from a carriageway or cartway; the only other possible remedy being by indictment.

HOUSE OR TRADE REFUSE?—"Justice" writes: A confectioner whose residence is attached to his business premises places in his refuse receptacle for collection by the corporation ordinary house refuse and refuse from his business. The latter consists of cardboard boxes, preserved fruit tins, bottles, shop sweepings, and ashes or clinker from his bakehouse. (1) If house and trade refuse are mixed, am I justified in declining to collect any? (2) Is refuse from a confectioner's business house or trade refuse? The confectioner caters for visitors, and meals are taken in the shop. The corporation have undertaken the collection of house refuse.

(1) Not necessarily. By-laws to deal with the matter might be made under sec. 26 of the Public Health Acts Amendment Act, 1890. (2) In determining whether refuse is "house" or "trade" refuse, regard should be had rather to the nature of the refuse than to its origin, or the manner in which it is produced. In *Lyons & Co.* v. *City of London Corporation*, 1909, 7 L.G.R., 811, the refuse from a tea shop was held to be house refuse under the Public Health (London) Act, 1891, but in our opinion other refuse from a confectioner's business is not house refuse.

The Destructive Distillation of Fæces.*

By J. MENZIES.

The complete history of research work carried out on the treatment of excretory matter would be of great service to those whose interest lies not only in hygiene, but are concerned in the economic value of waste material. Unfortunately, however, little record has been kept of various experiments, probably due to the fact that most of them have produced negative results. The compounds produced by heating and burning fæces were known to the alchemists, and the preparation of ammonia, for example, was practised by the ancients as it is done to-day in certain parts of Egypt, but one hesitates to suggest that the process of destructive distillation was known or used.

In various old scientific works, as well as in the biographies of eminent men, some reference will occasionally be found on the subject indicating that in bygone days, no less than now, some attempt was being made to prove that excretory matter is of value other than as fertiliser, but the efforts were evidently concentrated in obtaining from fæces either one or other compound by an extraction process.

It is not within the scope of this paper to deal with any method of disposal except by distillation, but, to justify the existence of the scheme, some reference must be made to the ways in which this putrescent matter is rendered inert. I think it will be agreed that the safest method of destruction is by burning. This, however, is a costly practice, although efficient in the hands of expert labour. Take, for instance, camp sanitation where the fæces and fæcal urine are contained in a receptacle without the addition of an absorbent material; the liquid must be separated and disposed of separately before the solids are mixed with coal or other combustible material and incinerated. The quantity of fuel required to ensure combustion is approximately 25 per cent of the weight of fæces, and the temperature generated is so great that it frequently ruins the firebrick lining of the incinerator. The nature of the labour involved is one which causes continual anxiety to those responsible for the work.

Whether this method of disposal is restricted on account of expense, efficiency, labour trouble, or all three causes together, it is impossible to state, but it is, unfortunately, true that the bulk of material is disposed of—if one may use the word—by merely removing it from one place and dumping it in another.

Granted that this might be done without danger or nuisance, these factors, however, are not the removal contractors' first consideration.

The first serious attempt to treat sewage by distillation was made by Mr. J. C. Butterfield, at Barking, in 1870, and he obtained a patent for his process.

The results obtained by his distillation of lagooned sludge were so satisfactory that a plant to treat some tons at a time was erected, and further patents were granted.

In order that the process of distillation may be absolutely distinct from any other process of destruction, it may be as well to define it.

Destructive distillation, as distinct from ordinary distillation, is a term reserved by custom to the decomposition of vegetable or organic matter by heat alone—that is, without the aid of reagents—in a close vessel. The general object of simple distillation is the separation of substances of different degrees of volatility, while that of destructive distillation is the formation of compounds whose properties and composition are entirely different to the material distilled.

The vessels employed for this purpose are usually horizontal, vertical or inclined "retorts," built in brickwork, iron or clay, closed to exclude the air, and externally heated.

While in sewage or crude fæces, no oil and carbon exists *per se*; there is always present a certain amount of true fats and ammonia. These free compounds, however, are driven off by heat before distillation takes place.

The chemical decomposition of fæces is highly complex—an infinite variety of products is formed, which, however, readily divide into three:—

(1) A non-volatile residue consisting of mineral matter and elementary carbon, which contains chemically combined nitrogen.

(2) A part condensable at ordinary temperature which always readily separates into two distinct layers.

(*a*) An aqueous portion ammonia liquors.

(*b*) A semi-fluid viscid oil, and

(3) A gaseous production.

The following experiments have been carried out mostly with sewage press cake and fæces, which has been collected from military camps as raw material.

In the laboratory, distillation of sewage cake or fæces is a perfectly simple operation, and the results obtained would seem to warrant the establishment of a plant to treat the material on similar lines to the apparatus employed in the laboratory. A piece of 2-in. iron barrel, plugged at one end, and having a reducing socket at the other with a delivery pipe for the products of distillation, is the form of laboratory apparatus which has generally been employed. This retort is charged with material to be distilled, and heated to redness; the products of distillation are led through a Liebig's tube to condense the oils and ammonia liquor, thence into Woulff's bottles containing dilute sulphuric acid to absorb the ammonia, and the remaining uncondensable gas is passed through a column of oil to extract any light oils which may be present and thereafter burnt. Although the yield of products must vary to some considerable degree in accordance with the source of supply of raw material, and also with its nature, the results are fairly constant. For example, a sewage which has been precipitated by alumino-ferric contains a higher percentage of organic matter than a sample of lime-press cake. Also trades waste has some considerable influence on the quantity and composition of the products of distillation. Again, crude fæces containing no foreign matter and a comparatively low percentage of natural mineral salts produces a relatively higher yield of hydrocarbons.

The average of forty-eight samples of press cake containing 60 per cent moisture and distilled in the laboratory shows, per ton:—

Oil	9 gals
Ammonia (calculated as sulphate)	60 lb.
Spirit	0·75 gal.
Gas	5,500 cub. ft.
Residue	750 lb.

Average of twelve samples of crude fæces calculated per ton:—

Oil	16 gals.
Ammonia (as sulphate)	88 lb.
Gas	3,200 cub. ft.
Residue	240 lb.

These experiments were carried out without the use of an exhaust to reduce the pressure in the retort, or of steam to increase the yield of ammonia.

Experiments on a large scale have been made in practically every known type of retort with press cake, some of the results showing greater yields than laboratory tests; but I believe, without exception, success has only been recorded in cases where the press cake has been dried previous to its being charged into the retorts.

By success I mean that everything has been taken into consideration—initial outlay on plant, cost of labour, and fuel balanced against yields, and comparison made against other forms of disposal.

One is tempted here to point out once more the difference between laboratory and works practice, but in the case of sewage cake it is impossible for the chemist with laboratory apparatus to demonstrate the behaviour of the material in bulk, and here perhaps lies the chief reason why so many of these elaborate experiments have been abandoned.

Two fundamental conditions are necessary when sewage is to be distilled in quantity, in either horizontal or vertical retorts. First, the total moisture content must not exceed 20 per cent, and secondly, a bulk of material in a retort must be broken up by the addition of an inert material, or by the existence of appliance in the retort for this purpose.

The following is the record of an experiment carried out in a specially constructed vertical retort, which,

* Paper read at a meeting of the Institute of Sanitary Engineers on the 3rd inst.

unfortunately, was considerably damaged by the temperature generated.

Moisture	20 per cent.
Material distilled ...	100 lb. per hr.
Ammonia liquor obtained equivalent to	8·6 lb. ammonia sulphate.
Crude oil	9 gals.
Steam blown through retort	1,600 lb.
Residue	8·96 lb.
Fuel consumption	12 lb. per hr.
Duration of test ...	24 hours.

The analysis of a sample of material dried and tested gave:

Volatile matter	32·00	
Fixed carbon	·985	
Silica	9·25	
Iron and alumina	12·95	43·50
Lime	21·40	
Carbonic acid	14·50	

Sewage is a bad conductor of heat, so that when charged it packs itself into a mass which becomes "dead" in the retort owing to the immobility of the particles. Time and temperature are therefore essential for the reactions to take place, and these essentials must be represented by elaborate plant and fuel expenditure—neither of which is warranted by the values recovered—and, I believe, neither is necessary.

Tests have been carried out in gas retorts at a temperature of about 1,000deg. Fahr., with sewage containing 55 per cent moisture. The material was charged to a thickness of 12 in. on the beds of the retorts, and after twelve hours only 8 per cent of the volatile matter had been driven off, and that only from the material which had been in direct contact with the retort.

Samples taken from the middle of the mass showed that the chemically combined water had not been eliminated.

A further experiment in a vertical retort heated to bright redness, with sewage containing only 25 per cent moisture, showed that seven hours were necessary to carbonise the material 4 in. thick. This retort was annular in form; therefore the heat penetration required was only 2 in. The length of the retort was 9 ft., and the weight of charge 600 lb.

A series of tests on various types of retorts, both horizontal and vertical, have proved that it is impossible in a practical way to heat material having a thickness of more than 3 in., and even then the total moisture content must be below 25 per cent. It is therefore obvious that if the distillation of this material is to be effected in ordinary retorts, either horizontal or vertical, preliminary drying is absolutely necessary. Possibly the elaboration of the plant employed for the distillation and the utilisation of the waste heat from furnace gases may reduce the cost of this operation, and so render it feasible in practice, but drying sewage is a delicate and dangerous operation if the product is to be subsequently distilled.

A plant commonly used for drying sewage is of the rotary type wherein furnace gases come in direct contact with the material. The capacity of even a large kiln—say 20 ft. long and 5 ft. in diameter—is only 10 to 12 tons per day, and any attempt to increase its capacity by a higher temperature is dangerous, through fine material firing. Further, the workmen engaged in the operation are frequently attacked by a gastric complaint, which causes painful and prolonged vomiting.

Unless the apparatus employed is of an elaborate nature, and special precautions are taken, I very much doubt if the sanitary engineer would give the scheme his unqualified approval.

The chemical reaction caused by heat which produces oils, &c., in the retort takes place at a temperature comparatively little higher than that necessary to break up the water chemically combined in the material; and as this represents probably 30 per cent of the total moisture in the sewage, either the drying operation comes dangerously near the point of disassociation, or a large quantity of moisture is left in the "dried" sewage.

A process to convert this hygroscopic moisture into water of hydration by exothermic action is in practice, but it would appear to be applicable only to sludge, to facilitate the better elimination of water by mechanical means. I believe that by filter-pressing the so-treated sludge, cakes containing only 40 per cent water are obtained, and in the subsequent drying by rotary kiln, some fuel economy is effected, but even here the "dry" product contains 12 per cent moisture.

The preliminary treatment of crude fæces presents still greater difficulties owing, firstly, to the viscous nature of the material; and, secondly, to the presence of fæcal urine; and, although many experiments have been made during the past year, especially to eliminate the moisture, previous to its disposal by fire, no practical results have been obtained.

At a large camp in the Midlands crude fæces are dried by the simple method of placing the stuff on galvanised iron sheets heated by coke fires. One is inclined to believe, however, that it may be a new form of punishment for military delinquents rather than a serious attempt to overcome a difficulty.

There is another point to be considered, and that is, no matter to what perfect combustion the chemist may work out his process, he will receive little commendation from the engineer if the operation has to be carried out in stages, as this must necessarily involve labour and supervision.

An analysis of the fundamental essentials for economic distillation would indicate the form of apparatus which would obviate the necessity of a stage process.

I have stated that when the crude material is heated to that point at which the chemically combined water is broken up, only a slightly higher temperature is necessary for decomposition; and, further, that when in the retort, owing to the immobility of the particles, only that portion which is in contact with the hot surface parts readily with its volatile matter. If these statements are borne out by facts, it would appear that a thin layer of fæces kept in constant agitation on hot plates enclosed in a vessel would suffer rapid destructive distillation.

An apparatus has been constructed on this principle, wherein crude fæces without preliminary treatment are fed; the products of distillation are obtained in a useful condition, and the operation is effected without creating nuisance. A description of this apparatus may be of interest, as it fulfils the claims made for this method of treatment. It consists of an iron framework carrying five plates staggered one above the other, so that when the material is raked to the end of one plate it drops on to the next below. The plates are hollow, and are heated by producer gas which, by a small fan, is drawn round baffles, so that the whole surface is evenly heated. An endless chain, working on sprocket wheels at either side of the plates, carries the rakes which plough through and carry forward the material. The whole apparatus, being cased in, is gastight, and it is provided with eduction pipes to carry off the products of distillation. The hydrocarbon and other vapours are induced by a centrifugal fan in conjunction with an extractor box, which takes the place of a condenser, and is quite efficient. The rakes are at intervals of about 12 in., so constructed that the first roughly spreads the material over the plate and carries only 20 per cent of the charge forward, the second ploughs the material spread by the first rake and carries forward a further portion, and so on, until the sixth and solid scraper cleans the plate. The feed hopper is synchronised with this solid scraper and immediately discharges behind it on to the top plate a fresh charge of material. The temperature of the gas entering the plates is approximately 800 deg. Fahr., so that, while there is little damage to the iron plates, the temperature is kept sufficiently high to cause rapid evaporation of the water. This is completely effected on the first and second plates. On the third plate decomposition of the fæces takes place, and is completed on the fifth. The presence of steam at this stage of the distillation—*i.e.*, on the fourth and fifth plates—would increase the yield of ammonia, but at the expense of the carbon content of the residue. The plates in this apparatus are 5 ft. by 2 ft., and the rakes travel over one plate in ten minutes. According to figures given to me by the Army authorities, the daily capacity of this machine is equal to about 2,000 men. The fuel consumption is 200 lb. per day of coal, but were the carbon in the residue burnt, together with the oil produced, this consumption would be reduced by at least 30 per cent. The carrying chains, fans, &c., are driven by a 3-h.p. gas engine supplied by the producer.

The apparatus occupies a floor space of 6 ft. by 4 ft., and is 5 ft. high over all.

The products of distillation are very interesting and complex. Very little research work has been carried out, but from what has been demonstrated there certainly appears to be an almost unlimited field for the research chemist. The results of a few preliminary tests will show that these products are valuable. It is not my purpose to attempt to prove

that the production of these materials is a commercial proposition, but to show that they possess more than academic value insomuch that they may be utilised to render the apparatus partially self-supporting.

Oil.—In its crude state this oil contains about 20 per cent of water, partly in combination and partly free. Some samples have yielded 30 per cent of a saponifiable oil, which, however, is of little interest commercially. The calorific value of the dry oil is 10,230 calories per gramme, or 18,415 B.T.U. (crude Texas being about 2,200). A sample subjected to test remained fluid until cooled to 20 deg. Fahr., had a specific gravity of 971 at 60 deg. Fahr., and a flash point of 256 deg. Fahr.

This oil contains less than ¼ per cent sulphur, and would therefore comply with Admiralty requirements for fuel oil.

Tests have been made in liquid fuel burners, and the results were satisfactory in every way, its physical characteristics lending it admirably for this purpose.

In fractionating, some trouble is caused in the stills when the oil is refined, owing probably to the water content, but the difficulty is overcome by the use of steam. The fractions are of great interest—the first being a colourless spirit having a gravity of 0·760, and vaporises at little over normal temperature. This spirit has a peculiar smell, due to a trace of pyridine bases. The second fraction is a very pale burning oil, which requires further refinement before it would be classed as a burning oil. The intermediate oils are light in colour, but have little viscosity. The last fraction, however, appears to be an excellent lubricating oil with good viscosity. The residual pitch is worthy of investigation. From its source it may be claimed that it is an organic pitch, and certainly it answers most of the tests for this compound. According to my information the pitch alone makes the oil worth over 6d. per gallon.

The presence of pyridine bases in both oil and ammonia liquor is easily recognisable by its distinctive smell, and as this is a valuable compound, and its separation well known in works practice, its existence further enhances the value of the crude oil.

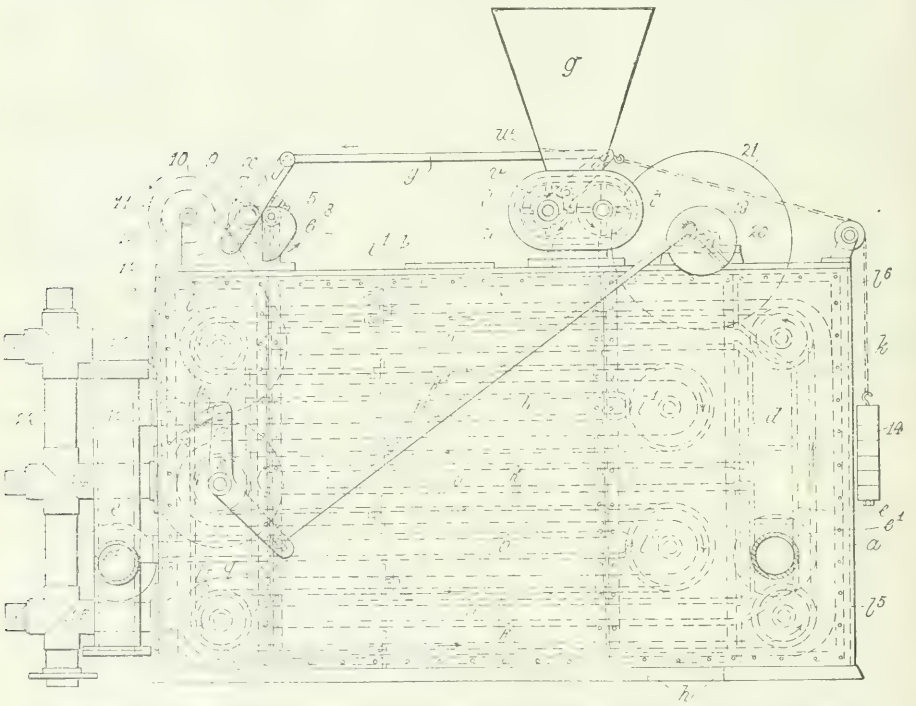
These pyridine bases derived from fæces are exceedingly complex in their composition, and undoubtedly are mixed with other and less recognisable organic bases.

Their commercial value is of interest, as at the moment two European Governments are seeking a denaturant for alcohol which will render the spirit unpotable. Pyridine is used to denature alcohol, but it is a well-known fact that methylated spirits are consumed by many people whose craving for alcohol overcomes its somewhat pronounced flavour. If, however, the first fraction obtained from sewage oil be mixed with the organic bases obtained from the same source, and a percentage of the mixture used to denature alcohol, the value of the alcohol for commercial purposes would not be depreciated; but I venture to state that one small dose would permanently satisfy the appetite of any person. Only repeated fractional distillation would eliminate from alcohol the added spirit, so that anyone desiring to produce a potable spirit from this denatured alcohol would quickly find it would not be a paying proposition.

The next product is ammonia. This is recovered as 6 oz. liquor, and is amenable to the ordinary recovery process. As, however, the greater portion of the fatty matter present in the raw material is carried over in a saponified condition with the ammonia liquor, the subsequent use of lime or soda to liberate the ammonia will yield calcium or sodium stearate in a useful condition.

A physical action of more than academic interest takes place when a small quantity of oil of the paraffin series is added to fæces or press cake before distillation. No chemical action whatever takes place, but when the mass is heated an atmosphere of paraffin vapour is created which seemingly acts as a vehicle to carry over the fats to the condenser. The fats so recovered are almost white when a low temperature is employed, and are dissolved in the ammonia liquor as soon as this is generated. This process eliminates only the free fats existing as such in the raw material, and in the case of press cake where a large percentage of the total fats are in combination with lime or other mineral, decomposition takes place.

The disposal of fæces in military camps by distillation, and the production of ammonia, is of value from



Sectional Side Elevation of Apparatus for Continuous Destructive Distillation of Fæces.

A, framework. B, hollow plates. C, D, end plates. E, F, flue pipes for gas from producer. G, feed hopper. H, residue pit. I, rakes. K, chains carrying rakes. L, sprockets; M, N, O, P, driving sprockets; T, cruciform cross section feed rolls; U, ratchet; V, pawl.

The Surveyor
And Municipal and County Engineer.

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...ed by public bodies. This ammonia liquor also contains pyridine bases, and it has been demonstrated that when fæces have been sprinkled with a small quantity of this ammonia liquor no flies will approach the material. As a bactericide also it ranks next to an 80 per cent solution of nicotine, and experiments show that B. typhosus is killed in 3½ hours. If, therefore, receptacles were washed out with this liquor, there would be less chance of danger emanating from this source.

The following report by the editor of the *Medical Officer* on an experiment with this liquor may be of interest, as it shows a further possible use were the distillation of fæces practised at or near the front by Army authorities.

TO RENDER ASPHYXIATING GAS INERT.

"In one of the great camps near London we have lately seen demonstrated a scheme to give absolute protection to troops against poisoning by mephitic gas attacks under conditions more severe than could possibly exist at the Front, and undoubtedly the inventor's claims were fully substantiated. Absolute simplicity and immunity from failure is the keynote of the whole scheme, which was carried out in the following manner: A pipe, fitted with spray nozzles about 6 ft. apart, was laid along the front of a regulation trench. A small pump was connected to the pipe, and a dilute solution of ammoniacal and other compounds forced through the sprays. The result was the formation of a 'screen' of liquid in the form of a cloud, extending to a height of about 8 ft. above the parapet of the trench. The 'enemy' gas was supplied through a perforated pipe, extending the whole length of the trench at a distance of only 15 ft. Chlorine was liberated through this pipe and directed against the screen at a pressure of 25 lb. to the square inch. Instantly and completely the whole of the poisonous gas was absorbed by the 'screen,' forming a white cloud, which was rapidly blown over the trench. During the test the trench was occupied, and although the rapid breathing of an excited ... served either during the test or afterwards. Heavy rain and a 15-mile-an-hour wind prevailed during a portion of the demonstration without affecting the ... to the man at the pump by his previously spraying the ground with a small quantity of the solution, thereby causing the chemical combination on the ground at a distance of about 8 ft. from the trench. The resultant white cloud is an important feature, as it warns troops of the approach of the gas, which otherwise may take them by surprise.

"The source of supply of the chemicals used for this scheme was from the destruction of fæces by the Westminster Destructor Company's system. A description of this apparatus has already been given in these columns, but a greatly improved portable type has been evolved, which makes the foregoing proposal to render mephitic gas inert by utilising material at hand valuable and worthy of fullest investigation. The utility of the scheme is not absolutely dependent on the near presence of the apparatus, as the liquor could be sprayed by means of the ordinary pumps already supplied by the War Office, at points 100 yds. or so apart all along the trenches. The only additional plant essential to its adoption is the canvas piping with nozzles, through which the liquor is sprayed along the front of the trench."

The last portion of the volatile matters to be considered is the uncondensable gas. Theoretically, the quantity of gas formed should be more than sufficient for the evaporation of the water content, but in practice extraneous fuel is required for distillation.

Analysis of the gas shows the following composition:

Carbonic acid, CO_2	18·4
Ethylene, &c., C_2H_4, etc	15·9
Carbon monoxide, CO	7·5
Marsh gas, CH_4 ...	13·8
Hydrogen, H	28·2
Nitrogen, N	15·5

The analysis indicates a gas of very high calorific value. It has a peculiar smell, difficult to define, an acid taste, and is almost colourless.

During a test a quantity of this gas accumulated in the scrubber, which consisted of a cast-iron column 10 ft. high, 3 ft. in diameter, and nearly ¾ in. thick. A workman searching for a leak with a naked light exploded the gas, and pieces of the apparatus were found nearly 100 yds. away.

As this gas is passed through a centrifugal extractor it contains no tar or dust, and may be utilised as power in a gas engine to drive the plant or to augment the supply from the producer. The supply is continuous, so long as material is being carbonised on the fourth and fifth plates in the apparatus described.

The residual matter from the distillation consists of carbon with lime, iron, magnesia, phosphates, &c. It is a black, odourless, friable material in fine powder. From crude fæces the residue contains nearly 50 per cent carbon, and as the material is naturally non-caking it may be mixed with the coal used in the gas producer, to decrease the extraneous fuel consumption, or when mixed with the oil and roughly briquetted, yields in the producer gas of a high calorific value.

Analysis of press cake residue shows the following ... sition:

Siliceous matter ...	55·00	66·30
Iron oxide and alumina ..	13·25	7·30
Calcium carbonate ...	13·71	3·14
Carbon	14·74	20·40
Magnesia	traces	·07
Phosphoric acid ...	1·20	1·14
Moisture ..	2·20	—
Sulphur	not determined	1·09
	—	—
	100	99·74

Various experiments have been tried to utilise the residue from press cake as a precipitant for raw sewage, and the results indicate that this may be advantageous; but as these tests have been confined to the laboratory, it is impossible to form a definite opinion as to its practical application.

In camp sanitary work it frequently happens that a quantity of water is added to the fæces, which naturally renders it difficult to handle; but this trouble may be overcome by adding the residue to the raw material, and as it is an excellent absorbent, a comparatively small quantity is necessary to render the fæces fit for treatment on the plates. As, too, the residue contains phosphates and chemically combined nitrogen, by its repeated use as stated, these constituents will become concentrated to some degree, making the residue of value as a fertiliser.

From the records of tests made both in the laboratory and on a practical basis, there appears to be little doubt that the destructive distillation is possible and feasible, and that such a scheme for the disposal of nightsoil would embody the two factors required by the sanitary engineers—viz., economy and hygiene.

At the meeting of the Institute of Sanitary Engineers at which Mr. Menzies' paper was read a hearty vote of thanks was accorded to the author on the motion of the president, Mr. A. P. I. Cotterell, M.INST.C.E., seconded by Mr. H. Percy Boulnois, M.INST.C.E.

Electrolytic Sewage Treatment.*

By W. L. BENHAM.

In the early part of 1914 the council of the city of Durant, Okla., decided to build a modern sewage treatment plant to take care of the increasing needs of the municipality for the treatment of sewage, and after considerable investigation it was decided to build an electrolytic treatment plant. The site was located north-east of the city on ground at such an elevation that the effluent from the plant could be emptied into a small creek, which is always dry except during rainy periods. The sewage is carried to the plant by two separate main outfall lines. The plant was put in operation in August, 1914, during a very dry period, and after some time it was decided to have a test made, which would show the efficiency of the treatment. During the month of August, under the direction of L. G. Lautzenhiser, of the Electro-Sanitation Company, Los Angeles, Cal., continued series of tests were made by Prof. Louis A. Turley, at that time State bacteriologist of Oklahoma, and a report was made by him covering his findings.

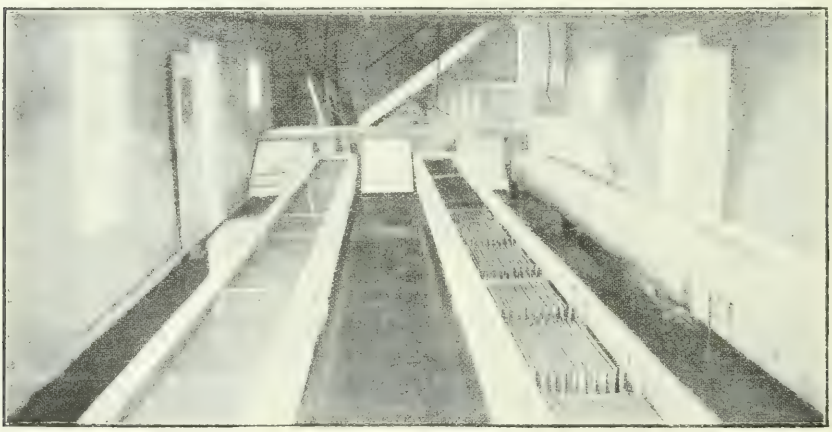
The plant is a combination of a two-story settling basin, a storage reservoir, generator-house, trough-house (where the electrolytic troughs are located), and a sludge bed.

The settling basin is of reinforced concrete, 30 by 40 ft. inside measurement and 12 ft. deep. The troughs are provided fourteen vents, so arranged as to allow the scum and gases to rise to the surface. These vents are 8 ft. apart on centres, and at the apex of each trough there is provided a scum drain of 8-in. cast-iron pipe equipped with a valve, so that scum or floating sludge can be carried off from time to time to the sludge bed. The hoppers are constructed of 2-in. by 6-in. oak tongue and grooved lumber, as are also the vertical vents.

The storage basin is of reinforced concrete, and of 72,000 gallons capacity. The idea of this basin is to allow the effluent from the settling basin to be stored up and to permit the sewage to be treated intermittently, thus avoiding the necessity of running the plant continuously. The basin was designed with a view of taking care of the night flow.

Above the storage basin is a motor generator house or room in which are placed the generators. These generators are composed of three separate units, specially designed so as to generate current at the rate of 400 ampères and 4 volts. A separate switchboard is provided for each generator, on which are mounted ammeters, voltmeters, rheostats, starting boxes and switches.

From the storage basin the sewage is conducted to the electrolytic troughs which are housed in a brick



Troughs with their Electrodes in which Sewage is Treated at Durant.

bottom of these basins is composed of fifteen inverted pyramids in the form of hoppers, and each is provided with a bottom drain so arranged that sludge can be drained out on to the sludge bed or into the adjoining creek. This arrangement is accomplished by means of valves placed in manholes outside of the basin. The drain pipes and valves are so arranged that the transverse hoppers or bottoms can be drained in sets of three at a time, there being five manholes with two valves in each. It was the idea that sufficient drainage could be accomplished with a much less depth than if fewer drains were provided, and to permit the entire basin to be drained at times when it might become necessary, due to sludge deposits, to clean out the basin, also to inspect the interior at any time. The bed of the creek is about 2 ft. lower than the bottom of the hoppers, thus providing ample fall. These drains are cast-iron bell and spigot pipe, 8 in. and 10 in. in diameter.

Above the drainage hoppers, at a distance of about 3 ft., were constructed Y-shaped troughs or hoppers, which extend across the basin at right angles to the long side. The apex of these troughs is 6 ft. below the top wall of the basin and 4 ft. below the water level. The bottoms of the troughs are 8 ft. 9 in. below the water level. The side of each trough or hopper at the bottom overlaps by about 6 in. the other side, so as to prevent any solid matter from rising to the surface, due to gas bubbles. At the apex of the

building. The flow is controlled by means of valves at the upper end of each trough. There are three troughs holding the electrodes, these troughs being 30 ft. long, 22 in. wide, and 18 in. deep, inside measurement. From the troughs the sewage empties into a concrete open channel, thence is carried to a manhole into the creek. A flap valve is provided at the creek to prevent the backing up of flood water.

At the side of the trough-house is located the sludge bed, 20 ft. wide, 40 ft. long, and 3 ft. deep. This trough is provided with underdrains, which consist of 6-in. vitrified sewer pipe laid with open joints. On top of these drains is selected sand. The sub-drains are connected with an outfall line to the creek, which is also provided with a valve to prevent the backing up of water from the creek.

The process of treatment is as follows:—

Sewage from the mains is discharged into a concrete channel extending the full length of the settling basin, and is admitted to the basin by means of five conduits, open at the top, which descend through the wall of the chamber and open into same a little below the level of the apexes of the hoods or troughs and between them. The tank was designed with a view of retaining the sewage for a two-hour period based on one-eighth of the average flow, and tests have shown that this result has been accomplished. Accurate gaugings of sewage were taken before the tank was designed. The sewage flows from the entrance chamber across to the other side and into another

* Extract from article in New York *Municipal Engineering*.

[illegible] of flume bracketed to the side wall. [illegible] necessary for the sewage to flow over weirs [illegible] the channel.

From the settling [illegible] compartments and [illegible] the bracketed flumes the sewage flows to the reservoir or equalising basin, and is stored there [illegible] the basin is filled. Then the treatment process is started and the sewage is admitted to the electrolytic troughs, where it is allowed to flow through [illegible] at the rate of about 7,000 gallons per hour, which rate has been demonstrated to give the best results. The sewage may be run [illegible] or all at one time.

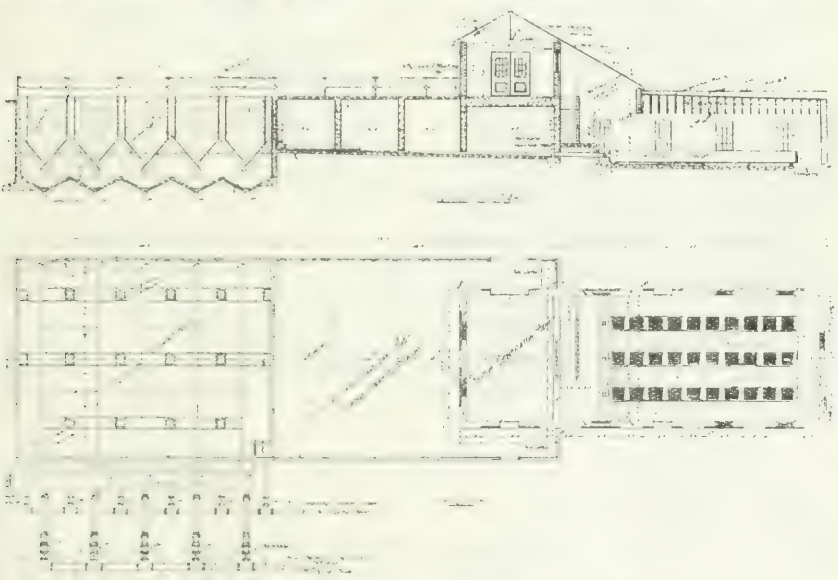
There are ten sets of electrodes in each set, consisting of twenty-seven [illegible] in. thick, and separated from each other by a vulcanite rod rubber bushing. These electrode sets are suspended by [illegible] from [illegible] of the troughs, and connected to one main [illegible] across the tank. Metal baffles are provided in each trough so as to direct sewage through plates and eliminate dead pockets. On top of each plate is a copper strip bent over each plate.

The following is abstracted from the report of Prof. J. A. Turley, dated September 5, 1914:—

Durant was selected as the place to make the tests on account of the character of its preliminary treatment of the sewage.

Durant's population [illegible] 7,000. It has separate sewers, with 134 [illegible] with the domestic [illegible] sewage in the chamber was comparatively clear and free from solid matter early in the morning, so that some morning the chamber might easily have been mistaken for the reservoir of the city waterworks. About 9.30 the sewage began to be murky, and the solid matter to increase. This increase continued until 5 p.m., at which hour we usually left the plant, and it probably extended into the night. But some time during the night after the kitchen wastes for the day had been turned into the sewer, the sewage began to clear.

In the description of the chamber above given mention was made of the fact that the solid matter on being discharged into the chamber would sink and pass under the hoods. In general this was the result, but it did not wholly work out in practice. The greater part of the solid matter did settle to the bottom, but a considerable part of it rose to the top and floated about as scum. This took place to such a degree that it was necessary to skim the chamber frequently, and the odour of this matter decaying on the surface was at times quite offensive. Besides these objections, this solid matter passed over the weir, and so went to the electrolytic troughs, and, of course, passed through them little, if any, changed, and appeared with the treated effluent as raw sewage at the discharge of the latter into the stream bed. No system of purification could be expected, in the time the sewage was passing through the troughs, to



PLAN OF ELECTROLYTIC SEWAGE TREATMENT PLANT AT DURANT.
Section on A B (left), showing [illegible] electrolytic troughs at right.

tem, including two laundries, five hotels, six boarding-houses, six restaurants, five confectioneries with soda fountains, and five drug stores with soda fountains, and no trade wastes other than the laundries. After a heavy rain the sewage becomes a mass of heavy mud, on account of the dirt that is washed through the manholes, and a considerable quantity of ground water seeps through the walls of the manholes into the sewers.

The average daily quantity of sewage is estimated at 428,000 gallons, about 20,000 gallons per day coming from the laundries. The sewage from the laundries is fairly uniform, and contains a washing compound known as "Wyandot," which is a soda preparation. The sewage from other sources is most variable in amount and character. Besides the usual kitchen and bath-room wastes, all manner of articles that can be got into the sewer come to the plant. These include newspapers, cloths, vegetable and fruit refuse, drawings of fowls, and various insoluble matter. Of course, a large part of these was caught by the screen and in the inlet channel, but a considerable amount passed through the screen and into the chamber. Ground water dilutes it considerably at times, especially during and for a day or two after a heavy rain.

The solid matter in the sewage was quite variable at different times during the twenty-four hours. The dispose of decomposed pieces as large as a marble, as were many of the pieces noticed. This condition was observed when the plant was first visited, and its significance as affecting the effluent was fully appreciated, but it was thought best to test the plant as it was before suggesting any changes. Accordingly, the testing was begun as soon as possible, and the tests included in the "first series" below are those made with the plant in this condition. At the end of this series it was suggested to the authorities that the condition should be changed. It was further suggested that this could be accomplished by running chutes from the orifices into the chamber to conduct the entire sewage under the hoods, where all the solids, the floating as well as the heavier, could be confined, thus avoiding the scum and the carrying over of undigested solids to the treating troughs.

This suggestion was carried out, and it was found that not only was the scum done away with and the raw floating matter arrested, but better circulation in the settling chamber was established. This was also increased by cutting recesses 2 ft. wide and 6 in. deep in the wall of the weir to the discharge channel. These recesses, five in number, were cut in line with the vent flues rising from the apexes of the hoods. The water level was thus lowered about 4 in., and the period of retention slightly reduced.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, assoc.m.inst.c.e.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction*

QUESTIONS.

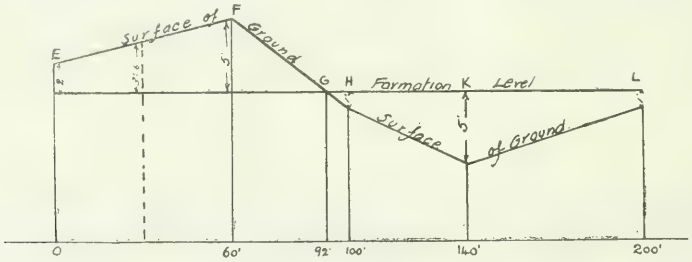
This week answers are invited to the following questions:—

511. Tramway Construction.—Discuss spiralisation in tramway construction. (J. D., *West Hartlepool.*)

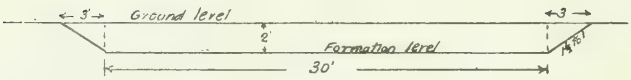
512. Hydraulic Gradient.—A horizontal main consists of 5,000 ft. of 6-in., 5,000 ft. of 9-in., and 5,000 ft. of 12-in. diameter. The velocity in the 6-in. is 12 ft. per second, and the pressure head 50 ft. at the inlet. Sketch the hydraulic gradient (*a*) supposing that only the skin friction is considered; (*b*) supposing that both skin friction and the losses of head due to abrupt changes of section are considered. Write down the expressions for the several losses of head. ("Enquirer.")

513. Hydraulics.—Calculate the percentage loss of horse-power per 1,000 yds. in hydraulic transmission through clean cast-iron pipes 4½ in. diameter, with water velocities 2, 3 and 4 ft. per second, and with pressures 200 lb., 700 lb. and 1,200 lb. per square inch—that is, in all, 9 percentage losses, and represent your calculated results by curves. ("Enquirer.")

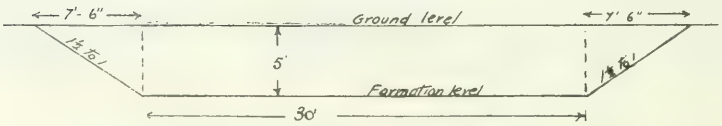
514. Water Supply. A storage reservoir and a service reservoir are situated at a distance of 5 miles apart, and are connected by a 12-in. main, which, at a point 1 mile from the service reservoir, feeds a 10-in. distributing main. The top-water levels of the storage and service reservoirs are 850 and 750 ft. respectively above ordnance datum, and the level at which the distributing main leaves the trunk main is 400 ft. above ordnance datum. When water is passing into the distributing main at the rate of 60,000 gallons per hour, what will be the (1) pressure in the trunk main at the connection with the distributing main? (2) the quantity of water passing from each reservoir towards that point? and (3) the hydraulic gradients from the reservoirs to the junction of the trunk and distributing mains? ("Ionic.")



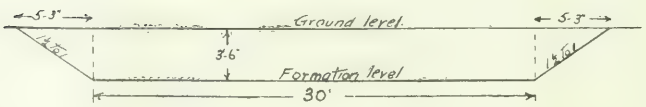
Longitudinal Section Fig I.



Cross Section at E. Fig II.



Cross Section at F. Fig III



Cross Section 30 feet from E. Fig IV

Diagrams accompanying Reply to Question 508.

REPLIES TO QUESTIONS.

508. Street Construction.—Some new streets are to be laid out involving considerable cutting and filling of the ground. Longitudinal sections of the ground showing the levels of the new road have been prepared. The cutting and filling have to be measured up as the work proceeds. What is the best method of doing this? (Polox.)

Having plotted the longitudinal section of the ground along the centre line of a proposed road to a

scale, and having drawn a line on the section representing the finished surface of the road, the next thing to do is to indicate the formation level by a thin line, which will usually be about 15 in. below the finished surface. This line should, as far as possible, equalise the cutting and filling. If the ground is sloping sidelong it will be necessary to have a few cross-sections, so as to be in a position to carefully estimate the cutting and filling required. This centre line of the longitudinal section, if not already done, should now be transferred to the ground, which is done by means of pegs driven into the ground at, say, every 100 ft. The beginning and ending of the road, as well as the beginning and ending of each section of cutting and filling, should be marked by two pegs driven into the ground side by side. All these pegs should have the depth below or height above formation level marked upon them. The width at formation level will now have to be settled, which may be about 30 or 40 ft., and it is usual to make the side slopes 1½ to 1. It is now possible to divide the lengths of cutting and filling into sections of prismoidal cross-section, the contents of which can be calculated from either Bidder's or McNeill's tables, or from the following formula:—

$$Q = \frac{L}{6}(A + a + 4M)$$

Where Q = volume in cubic ft.,
L = length of section in feet,
A = area of one end of prism,
a = area of other end of prism,
M = area of middle section of prism.

In Fig. 1, let us calculate the number of cubic yards of cutting from E to F in the assumed longitudinal section, by the above formula, taking the formation width as 30 ft. and slopes 1½ to 1. Figs. 2, 4 and 3 represent cross-sections at E and F and midway between E and F.

$$a = 30 \times 2 + 3 \times 2 = 66$$
$$A = 30 \times 5 + 7\frac{1}{2} \times 5 = 187\frac{1}{2}$$
$$M = 30 \times 3\frac{1}{2} + 7\frac{1}{2} \times 3\frac{1}{2} = 123$$
$$L = 60 \text{ feet.}$$
$$\therefore Q = \frac{60}{6}(187\frac{1}{2} + 66 + 123)$$
$$= 7,455 \text{ cubic feet}$$
$$276 \text{ cubic yards.}$$

On checking this with McNeill's tables it is found to be correct. Sections FG, GH, HK and KL can now be proceeded with, and their volumes calculated in a similar manner. (J. G. W., *Downpatrick.*)

PERSONAL.

Mr. H. W. Marsden, borough surveyor of Richmond (Yorks), has had his salary increased by £10 per annum.

Lieutenant Edward Stead, ASSOC.M.INST.C.E., county surveyor of Somerset, has been promoted to Captain in the Royal Engineers, to date from the commencement of his duties as a lieutenant.

Mr. J. Draper, surveyor and inspector to the Saltburn Urban District Council, having joined the Colours, Mr. R. Wood, the clerk, has been appointed to discharge the duties of the offices "so far as possible."

Mr. E. Park, one of the surveyors of the Horncastle Rural District Council, has been appointed surveyor for the whole district during the war. As a measure of economy, the council have dispensed with the services of Mr. John Davis, surveyor of the North Subdistrict, at the same time expressing satisfaction at the manner in which he had carried out his duties.

Mr. F. W. Smart has been unanimously appointed county surveyor of Bedfordshire, in succession to the late Mr. W. H. Leete. Mr. Smart was appointed deputy county surveyor last July. He was articled to the late Mr. W. H. Leete, after which he became assistant in the county surveyor's office, and next served as district surveyor for seven and a-half years. He was then promoted to the position of chief assistant, which he held for six years. Mr. Smart is a member of the Institution of Municipal and County Engineers.

Messrs. Arthur Parry and F. H. Ellis write: "We notice in the 'Personal' column of your last issue a report to the effect that we have been given permission to join the Forces, and that Mr. W. B. Marsden has been deputed to carry on our work as highway surveyor during our absence. Will you please contradict the latter portion of this report? We ask this because we have already received correspondence on the matter. The council have not yet decided what steps will be taken to carry on the work while we are away. The council instructed Mr. Marsden, sanitary surveyor and North District inspector of nuisances, to carry on the work of Mr. A. Hurd, South District inspector of nuisances, who has already joined the Sanitary Section of the R.A.M.C."

OBITUARY.

The funeral of Mr T. H. B. Heslop, county surveyor of Norfolk, whose death was recorded in THE SURVEYOR last week, took place on Friday last at Eaton, Norwich. Bishop Hamlyn, rector of Eaton, read the service, which was impressive in its simplicity. The chief mourners were Mrs. Heslop (widow), Mr. Heslop (son), Mrs. H. R. Fletcher (daughter), Mr. J. Heslop (brother), Mr. H. R. Fletcher (son-in-law), Mrs. Fairweather (sister), Mrs. Martin (sister), Mr. Fairweather, junr., and Miss Mawdesley. The county council was represented by Mr. J. Sancroft Holmes (chairman) and a large number of members, while the county surveyor's department was represented by Mr. L. B. Sanders (chief clerk), and the following district surveyors: Messrs. A. Fowler (Wymondham), R. G. Coates (Acle), D. Johnson (Dereham), J. Kennedy (Docking), R. Nelson (Watlington), R. Gibson (Gayton), D. Shields (Fakenham), J. S. Cooke (Loddon), G. Rodley (North Walsham), W. W. Gladwell (Diss), W. A. Tillotson (Watton), and G. E. W. Mullard (Downham Market); and E. Beck (foreman of the county council stores, Wymondham), and James Dawson, James Land, and R. Beales (representing the county council main road men).

THE LATE MR. T. H. B. HESLOP.
"Eastern Daily Press" Photo.

Mr. David James Phillips, who, we regret to state, was killed in the Gallipoli Peninsula on September 22nd last, was a member of the staff of the county surveyor for West Suffolk, and left to join the Hawke Battalion, 1st Naval Brigade, Royal Naval Division, in December, 1914. Mr. Phillips was a Glamorganshire man, and was educated at Queen's College, Taunton, and Aberystwith University College. At the latter college he received some military training with the Officers' Training Corps. He was twenty-seven years of age. His death will be keenly felt by his many friends. Mr. Phillips was one of five members of the West Suffolk county surveyor's staff who joined His Majesty's Forces last year, the other four being Messrs. T. L. Burnside, A. J. Hayward, H. E. Morris, and G. Thomas.

Dampness in Basements.—The storage benefit of a basement is often minimised through dampness. We learn that two such basements in Birmingham have now been successfully treated with a blue brick lining, the bricks being bedded with Pudlood cement mortar.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Brandon and Byshottles U.D.C.—The surveyor, Mr. G. G. Donkin, has been instructed to prepare amended plans for an isolation hospital.

Darlington T.C.—It is proposed to purchase a site in Woodlands-road for a new school.

Downham Market U.D.C. A conference has been arranged with the rural district council with respect to the provision of an isolation hospital.

Essex C.C.—The Education Committee are appealing to the Local Government Board to withdraw their refusal to sanction loans for school sites at Boxted and Hornchurch, on the ground that the land was purchased before the outbreak of war.

Glasgow T.C.—At yesterday's meeting the town council had before them a recommendation that the contracts which have already been entered into for the new municipal buildings be proceeded with and completed; that consideration of the question of entering into contracts for the plumber, joiner, and other works necessary to complete the new buildings, also the south bridge and the tunnel thereunder, be postponed until after January 31st next; and that the alterations on the existing buildings and the construction of the north connecting bridge be delayed until after the war.

Newcastle (Ireland) U.D.C.—The surveyor, Mr. D. M. Gracey, has received instructions to report on the provision of shelters on the promenade.

HOUSING AND TOWN PLANNING.

Foleshill R.D.C.—The surveyor, Mr. A. E. Newey, reports that building operations are to proceed in connection with the provision of twelve workmen's dwellings at Foleshill and fifteen at Bedworth.

Market Harborough U.D.C. It has been decided to seek powers for a town-planning scheme.

REFUSE COLLECTION AND DISPOSAL.

Glasgow T.C.—Owing to the fact that 460 men belonging to the cleansing department have enlisted, the city corporation are appealing to householders to burn all combustible material, such as potato and other vegetable peelings, cabbage leaves, refuse of meat and other food, and waste paper.

ROADS AND MATERIALS.

Anglesey C.C.—Complaints relating to the dangerous nature of the roads as the result of tar spraying were made by the representatives of several districts. It was stated that, especially on gradients, the slipperiness of the surface was the frequent cause of accidents to horses and cattle. The county surveyor, Mr. W. E. Jones, pointed out that the complaint only applied to gradients, and even there he thought accidents could be avoided by the exercise of a little care. The remedy he suggested was the application of chippings or sand for the slippery parts.

Barking U.D.C.—Mr. R. H. Lay, acting surveyor, reported that, as directed, he had offered the Thames Stone Company the sum of 2s. 10d. per yard super. for about 10,000 yds. of artificial stone paving flags at the council's wharf, and the sum of £57 for sundry articles, payment to be made by four equal half-yearly instalments, which terms the company had accepted.

Cookstown U.D.C.—The surveyor reported that a new scarifier had been delivered and had been working last week in Molesworth-road. He has estimated that the cost of hand-picking that road would be £30, and that with the scarifier it would be £3, but he found that it actually would cost less than £1. Satisfaction was expressed at the work done, and it was decided to remake part of the main street, where the traffic was heavy, and finish half of it with tar-screenings as an experiment.

East Kerrier R.D.C.—The new surveyor, Mr. Mitchell, reported that he had been all over the district, and had journeyed 1,000 miles in the past five weeks. The roads were in want of repair. The crusts were thin, and in many cases the centres were lower than the sides, due to scarcity of metal for some years past.

Gillingham T.C.—The borough surveyor, Mr. J. L. Redfern, reported recently the receipt of a communication from the Road Board stating that it was proposed to make extensive and important alterations on the Great Lines. There would be a very extensive camp of hutments—eighty or more large buildings. There would also be upwards of $\frac{3}{4}$ mile of roadway to be made, and the local authority was invited to act as the agents to the department, all expenses being borne by the department. He (the borough surveyor) proposed to go to London to have a consultation as to the class of roadway they wanted made. They wanted the council to execute the work as economically and as expeditiously as possible. The council decided to fall in with the wishes of the department in the matter.

Holywood U.D.C.—The surveyor, Mr. J. Hanna, has received instructions to prepare estimates for a number of proposed improvement schemes.

Horsham R.D.C.—The surveyor, Mr. R. Renwick, has been authorised to proceed with the War Office scheme for making roads at Roffey Camp.

Leek U.D.C.—The council are considering a scheme for the extension and widening of Strangman-street.

Norden U.D.C.—It was reported recently that the county council had made a grant of £300 for remaking two lengths of the main road between Red Lumb-lane-end, and the Old Moorcock, Ashworth Moor.

Pontypool R.D.C. — The county council have approved the amended scheme for the improvement of Black-road, Llanfrechfa Lower, and the work will be put in hand as soon as practicable.

Sheffield T.C.—The Improvement Committee recommend the purchase of land in Borough-road and Owlerton for a widening scheme.

Surrey C.C.—The Highways Committee report that the cost of widening Cobham Bridge had been £5,735, the estimate being £6,400. A grant of £1,100 was made by the Road Board. The cost of widening Windows Bridge was £2,346, the estimate being £2,500, and a grant of £100 was made by the Road Board. The committee have granted an increase of 2s. a week to all roadmen in their employment earning less than 30s. a week, but in no case is the increase to have the effect of making the wages more than 30s.

Tavistock R.D.C. — The surveyor, Mr. G. G. Cornish, reported that the actual cost of Horndon-road, Marytavy, over which there is traction traffic in connection with Wheal Jewell Mine, from September, 1914, to September, 1915, was £352, or at the rate of £175 per mile, whereas the normal cost before the traffic was £10 a mile. It was resolved to represent the matter to the mining company, and ask them how much they were prepared to contribute.

Torquay T.C.—It has been agreed to pay £450 for land necessary for the widening of part of Torwood-street.

Turton U.D.C.—It is reported that the County Main Road and Bridges Committee have made additional grants amounting to £826 for the repair of main roads.

Westhampnett R.D.C.—With respect to a report as to the delay in the commencement of rolling in the Eastergate district owing to the shortage of labour, the council resolved that inquiries be made of the military authorities at Chichester Barracks in order to ascertain whether the services of any soldiers could be obtained to assist with the steam rolling during the winter. As to the maintenance of highways during the year ending March 31, 1917, the council adopted the principle that the main or arterial roads should be maintained in their present condition, but that in the case of contributory roads where little other than purely local traffic might be expected, the estimates should be reduced and the material limited to such quantities as might be required for emergency repairs only. The highway surveyors, Messrs. J. J. Budden and I. H. Hogben, were directed to prepare preliminary estimates for the consideration of the Highways Committee.

Westminster B.C.—The Works Committee recommend the carrying out of repairs in the Strand, Savoy-street and Carting lane, at an estimated cost of £900.

Worcester T.C.—Plans have been prepared for the repair of the Severn towing path.

SEWERAGE AND SEWAGE DISPOSAL.

Ballymoney U.D.C.—The surveyor, Mr. A. McMaster, has received instructions to report on the cost of laying a new sewer through part of Milltown.

Chatham T.C.—An agreement has been made with the Rochester Corporation to carry the sewer from New-road, near Fort Pitt, under the Rochester recreation ground.

Dover T.C.—A tender at £185 has been accepted for the pump work at the sewage disposal station.

Dudley T.C.—The borough surveyor, Mr. J. Gamage, has received instructions to prepare the necessary plans and sections for widening and sewering Bunn's lane, and for the making and sewering of the new roads on the Brewery Fields estate in connection with the housing scheme, and to invite tenders.

Haslemere U.D.C.—The proposed improvements at the sewage disposal works include the separation of the storm water from the sewage proper, and the installation of a new pumping plant. The estimated cost of the works is £840.

Hastings T.C.—It has been agreed to reconstruct the sewer at Wellington square at an estimated cost of £150.

Rugeley U.D.C.—It is proposed to lay a sewer from the junction manhole in Love lane, to the culvert leading to the Moor Farm tanks, at an estimated cost of £120.

Wigan T.C.—The town council have decided to carry out a scheme prepared by the borough engineer, Mr. A. T. Gooseman, for the utilising of 27 acres of land for sewage disposal purposes at the sewage farm at Hoscar Moss. The borough engineer pointed out that the existing carriers and manholes could be used, as well as 1,100 yds. of existing pipes which are laid, and which are not in use at the present time. The estimated cost of this work is £140. The borough engineer reported that the Local Government Board, when they deferred the execution of their new disposal scheme owing to the war, stated that the town council must bring into use for irrigation purposes as much land as is practicable for the production of good effluent.

WATER, GAS, AND ELECTRICITY.

Alloa T.C.—Tenders are being invited for a loan of £950 in connection with the electricity undertaking.

Axminster R.D.C.—The council have decided that the question of the provision of a water supply for Stockland shall stand over with the object of the council themselves carrying out a scheme in the spring.

Bishop Auckland U.D.C.—Messrs. Willcox & Raikes have been instructed to prepare plans and estimates for the intercepting sewer from Raby Cross to Wear Chare with a view to obtaining sanction to proceed with that portion of the scheme between Raby Cross and Cradock-street. Application is to be made to the Local Government Board to sanction a loan of £10,000.—The council have accepted the tender of Messrs. Crossley Brothers, at £550, for a gas engine and suction plant, and the tender of Messrs. Worthington, at £642, for pumps for the waterworks.

Birstall U.D.C.—A scheme has been arranged with the Bradford Corporation for supplying up to 1½in trunk main at Dudley Hill.

Gloucester T.C.—The corporation are advised to provide a water-softening plant at the electricity works.

Golborne U.D.C.—A sub-committee recommend the raising of the tower water tank with a view to augmenting the water pressure, subject to an arrangement being reached with the Ince Urban District Council.

Nuneaton T.C.—At Wednesday's meeting it was decided that a softening plant in connection with the Griff water supply be installed at a cost of between £600 and £700, the cost to be paid out of revenue. It was understood that the annual cost would be £270.

Plymouth T.C.—Several extensions of the electric cables have been agreed to.

Radcliffe U.D.C.—Consideration is being given to a proposal for the purchase of the Radcliffe and Pilkington gas undertaking.

Warminster U.D.C.—Official sanction has been given to the extension of the electric lighting order for another year.

MISCELLANEOUS.

Blaenavon U.D.C.—The council considered the position of Captain Edwards, the surveyor, enquiries having been made as to the payments he was at present receiving from the War Office. At an earlier date the council decided to grant Captain Edwards, who was then a lieutenant, £100 a year. Having considered the figures, the council decided to pay £25 a year. It was stated that Captain Edwards was in receipt of nearly £300 a year from the Army.

Clevedon U.D.C.—The surveyor, Mr. G. W. Knowles, reported that he had made a survey of empty buildings in the town suitable for billeting soldiers, with option to estimate for accommodation of such buildings.

Cuckfield R.D.C.—Applications from the highway surveyor, Mr. A. Macarthur, and sanitary surveyor, Mr. Robinson, for an increase to provide for the upkeep of their motor-cycles were received, and it was resolved that the allowances be increased from £26 to £36 per annum in each case.

Helensburgh T.C.—It has been resolved to make no allowances to men in the council's employment who enlist in the military or naval services after November 30th.

Hornsea U.D.C.—Upon the advice of the surveyor, Mr. W. E. Warburton, it has been agreed to purchase a fire escape at a cost of £67.

Kempston U.D.C.—The auditor reported that he had found the books in good order. It was with some hesitation that he passed the payment of £70 to the surveyor in respect of extra remuneration for work in supervising drainage connections. He had decided, however, that such work was independent of his office, but thought it was desirable that the duties the surveyor was expected to perform should be clearly stated in the terms of appointment. Mr. Riddy asked if it were possible to provide against an emergency he knew nothing about. At the time of the appointment of the surveyor the water scheme was only in the air. The chairman suggested that the Sanitary Committee might consider the auditor's recommendation, and this was agreed to.

Manchester T.C.—The Sanitary Committee have decided to make an application to the Committee of the Privy Council for Scientific and Industrial Research for a grant of £400 for the purpose of research into the efficiency of domestic heating appliances.

FOR OTHER ADVERTISEMENTS

See End of Paper.

URBAN DISTRICT COUNCIL OF FINCHLEY.

TAR FOR ROAD-SURFACE TREATMENT.

The Council of the above-named District invites Tenders for the Supply, in barrels, to the various Depots within its District, of about 55,000 gallons of Tar.

Full particulars may be had on application to the Council's Engineer and Surveyor at the undermentioned address.

E. H. LISTER,
Clerk of the Council.

Council Offices,
Church End,
Finchley, N.
November 10, 1915. (2,763)

URBAN DISTRICT COUNCIL OF FINCHLEY.

GRIT FOR TAR-PAINTING.

The Council of the above-named District invites Tenders for the Supply and Delivery of 900 tons of Gritting Material.

Full particulars may be had on application to the Council's Engineer and Surveyor at the undermentioned address.

E. H. LISTER,
Clerk of the Council.

Council Offices,
Church End,
Finchley, N.
November 10, 1915. (2,762)

ROAD WORK AT THE FRONT.

AN EMERGENCY WATER CART.

We give below extracts from the letters of Lieutenant E. J. Stead, county surveyor of Somerset, who is serving at the Front :—

"October 14, 1915.—We had our first casualties yesterday. A party was building concrete shelters when the Germans spotted them and shelled. Two men were killed and two wounded. The rest of us managed to get to our dugouts until it was over. The enemy appear to be waking up around here, as they shelled the town again on Sunday night, Tuesday, and all last night. We all get to safe places while it lasts, and nobody was hurt. I was out again yesterday at daylight to attend to works shelled the night before, and some of our gangs work nightly. It is beautiful weather now with us, and plenty of sunshine, though rather cold. The country looks grand, as the autumn tints are showing on the trees; it will be a dreary spot in winter, and cold too! It is astonishing how the people seem to have got used to shells; of course, there are not many people left, but one occasionally meets on the road a very old man or a woman, perhaps with a little child toddling alongside, seemingly taking no notice of 'whizbangs' and suchlike. I suppose they have found out that a very large number of the shells do not touch anybody. Another curious thing about the country is the large number of 'Calvary' or praying altars all about at cross roads. They are all closed up now, but I think in peace times they will be open again for people to go and pray; it seems curious to us. Some of the churches are very fine, but mostly damaged.

"October 17, 1915.—You no doubt saw in the paper about a British gas attack, which I saw. I had a rough trip yesterday. It was my day to pay the native gangs, but the car went wrong—gear slipped—so we had to leave it and tramp. A French interpreter was with me, and we went about 15 miles; after this I had all my own company to pay. I continually get orders to have certain roads in good order and condition by a certain date, and it has to be done; first there is an inspection, then the materials to be arranged for, and then a native gang has to be turned on to them; this work is in addition to keeping up the roads we are reconstructing. We have had no shelling since I last wrote; perhaps our chaps are keeping them too busy.

"October 20, 1915.—I saw a bit of home to-day. On going into an A.S.C. office some miles from here, there was hanging on the wall an 'Alma James Clare' calendar for this year, with a picture of the shop front. I am going to inquire about it next time I am there, as I had no time to-day. We still have quite a lot of work to get through, but, having more or less settled down, we are getting more time to ourselves. We have heard very heavy gunning for two or three days, but to-day it is rather quiet again. We have managed to get hold of eight steam rollers, but the 'powers that be' forgot that a water cart was a necessary adjunct to a steam roller, so I am busy fixing up a substitute for a water cart. I managed to get a corrugated-iron tank, and rigged it up on an old country cart of three wheels, but it falls over if you look at it! We managed to get a tap and made a sprinkler, and turned it out to work. It was not a success, and I have laughed many a time since I saw it come back to the yard. It slipped in its bearings owing to the awful roads and the still more awful cart. When I saw it the tap was looking skywards at the top of the tank, and all the water was out of it. The men got their water from a pond some distance from the road, but when they reached the road there was no water left! Now I have got some water barrels to fix up. We have been making a steam-roller depot."

EALING COURT HOUSE.

Ealing Court House.

This new building, of which we give an illustration to-day, has been erected in Green Man-lane, Ealing, by the County Council of Middlesex, as an additional court house for the Brentford Petty Sessional Division of the county. The new building was designed by Mr. H. T. Wakelam, M.S.A., the county architect, who has had much experience in the erection of such buildings, he being the architect for new courts of the kind already built at Uxbridge, Acton, Hendon, Enfield, Harlesden, and elsewhere.

The new Ealing Court House is of a pleasing design (both externally and internally), and affords accommodation for the magisterial bench, clerk's office (public and private), caretaker's quarters, first and second courts (with a special court for juveniles, under the Children's Act), witnesses' rooms, offices for inspectors of weights and measures (public and private), reporters' room, council and solicitors' rooms, warrant officer's room, probation officers' room, warders' rooms (male and female), central waiting halls and corridors, with accommodation also for about twenty male and female prisoners.

The buildings have been excellently well planned for the convenient transaction of judicial business, and will we feel certain, be much appreciated by everyone having business within their walls. Mr. A. Monk, the well-known builder, of Edmonton was the contractor responsible for the work. The building was formally handed over by the chairman of the county council to the Petty Sessional Bench on Wednesday.

Omagh's New Town Hall.—The new town hall erected in Omagh by the urban district council at a cost of about £4,000 has been completed. The frontage of the new buildings is 47 ft., and they extend back a distance of over 160 ft. The main assembly hall is 85 ft. long, 37 ft. wide, and 28 ft. high, and can comfortably accommodate 660 people. The council chamber is situated at the top of the main stair, and is 33 ft. long, 21 ft. wide, and 12 ft. high.

Litigation Over a Crossing.—The Derby Corporation recovered judgment in the County Court last week against the Osmaston Estate Company for £13 for work in the making up of a footway on land which they had disposed of to Rolls-Royce, Limited. The claim was made under an agreement which empowered the corporation to determine when this and other deferred street works should be executed after notice to defendants. The surveyor deemed it necessary to construct a crossing over the footway with setts, instead of blue bricks, so as to carry wheeled traffic, and it was in respect of the extra cost so incurred that the claim was made. Defendants contended that all they were liable for was the expense of paving with blue bricks, the setts being laid down solely for the benefit of Rolls-Royce, Limited. In giving his decision, Judge Macpherson said it was clear that it was left to the discretion of the surveyor to say whether the crossing should be of more substantial structure than the remainder of the footway.

SEWAGE DISPOSAL IN STAFFORDSHIRE.*

By Dr. GEORGE REID,
County Medical Officer of Health.

The routine work under the Rivers Pollution Prevention Acts has proceeded on former lines. The systematic work of inspecting existing sewage disposal works has gone on uninterruptedly, and such cases as new works are completed, more and more time has to be devoted to this part of the work.

As regards sewage effluents, while special attention is directed to proposed or existing works, the works which have been thoroughly established are by no means overlooked. All are systematically inspected by the county river inspector, who at once reports to me any irregularities he observes. Needless to say, his visits are surprise ones, no previous notice being given of his intention to visit, and it speaks well for the good faith of the local authorities that his visits are hailed with appreciation rather than resentment.

It is customary to call the Public Health Committee's attention at the time to any serious irregularities which are noted in the management of sewage works, and the responsible authorities in such cases are invariably communicated with. Many lesser irregularities noted, however, are satisfactorily dealt with by myself, without troubling the committee, by merely calling the local surveyor's attention to them.

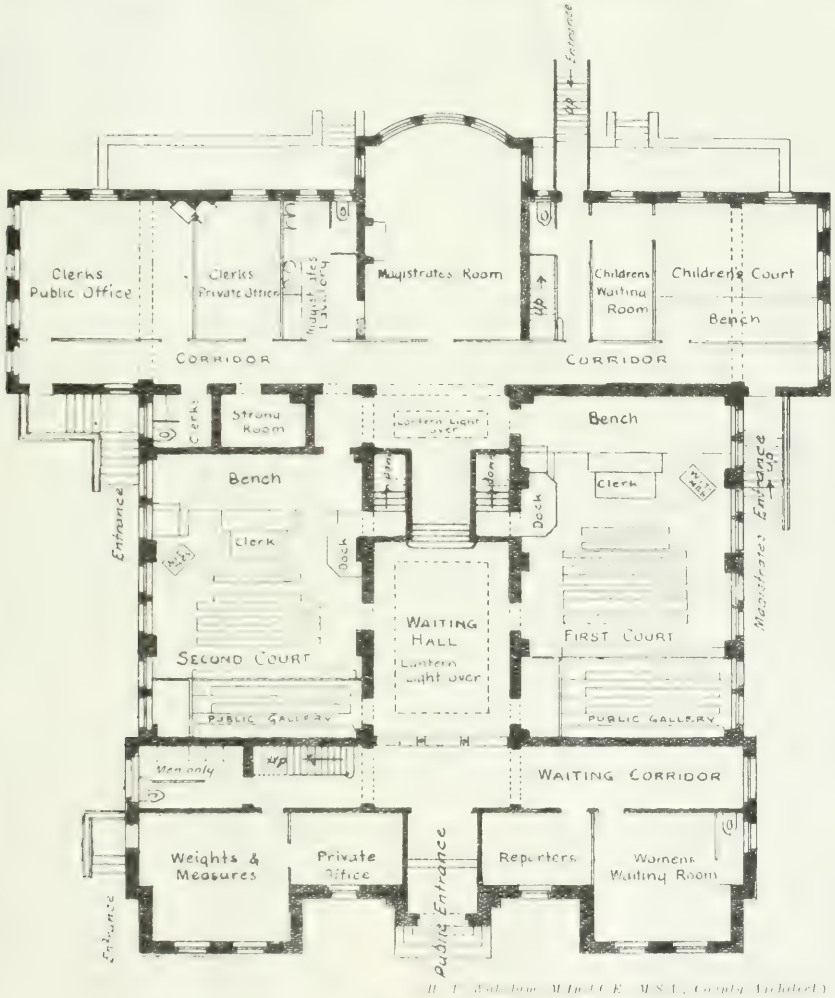
As regards the districts which drain into the river Tame, further progress has been made. I am glad to be able to state that at the new and extensive works at Walsall the whole sewage is now being treated with satisfactory results. The contract for the new works for Darlaston has been let, but the construction work has not been commenced, owing to the fact that the sanction for the necessary loan cannot be obtained under present circumstances.

The new works at Willenhall are now completed, and have recently been brought into operation.

From the new works at Bilston and Wednesbury good effluents continue to be discharged. At Oldbury, I understand that an extension of the primary contact bed is in contemplation, owing to an increased flow of chemical waste. At Tipton, the work of making house connections is still proceeding, and the sewage of about one-half of the population is now said to be dealt with at the disposal works, which continue to discharge a satisfactory effluent.

As regards the county borough of West Bromwich, I understand that a scheme for extending sewage disposal plant is being prepared.

As regards the north of the county, the provision of a sewage disposal scheme for Audley has unavoidably been postponed, owing to the fact that the Government, unless for urgent reasons, will not at the present time sanction any capital expenditure.



H. T. Soloman, M.Inst.C.E., M.S.A., County Architect.

EALING COURT HOUSE. GROUND FLOOR PLAN.

* Extract from annual report for 1914.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Why should a cow at Sleaford commit suicide by drinking weed-killer when, according to the report in the issue of The Surveyor of the 5th inst., new works of water supply were recently opened in this district in order to give a plentiful supply of water, not only to the inhabitants, but probably to cows as well? Is it not a well-known adage that "there is no accounting for taste"?

* * * *

Will the present mania for standardisation reach such a climax some day that an engineer will have to say to his draughtsman, "Take a standard pencil, and a standard drawing-board, tee-square, and set-squares, and design on a piece of standard paper a standard section of a carriageway to a standard scale, but before you set to work run out and buy some standard drawing pins"?

* * * *

Is not the parish council of Cheam, Surrey, to be congratulated that they have at last decided to call their fire brigade together by means of a hooter instead of letting off a bomb, the explosion of which caused a rather "jumpy" feeling among the inhabitants of this residential village?

* * * *

What has become of the ultra-violet ray treatment of water which many of us saw in operation at the Paris waterworks a few years ago? Has it been found to be a failure, or is the expense of an installation and subsequent working too great for practical use? Does it not seem as if the chlorine treatment is going to supersede many of the other methods which have been tried from time to time for the sterilisation of water?

* * * *

Is not the question of how we are to find employment for the large number of wounded and invalided ment from the front one that requires the deepest attention, not only from philanthropists, but from Parliament itself? Will not the same pressing questions arise when the war is over and hundreds of thousands of able-bodied men will be returning and require work? Is our present Parliament capable of grappling with this problem, or will they adopt that very convenient *laissez faire* process of "Wait and see"?

* * * *

Was Sir James Crichton-Browne justified in prophesying, in his presidential address to the Sanitary Inspectors' Association, that when the history of the present war came to be written its moral would probably be that this country had been "saved by sanitation"? Do we not all devoutly wish that this prophecy may be true, and that when the history of the war comes to be written it may not be stated that the country had been "lost by insanitation"?

* * * *

Is it altogether a matter of surprise that as the streets are now so darkened soon after sunset, places of amusement and shops are altering their hours of opening and closing? Does not this point to the advantages of the Daylight Saving Bill which was talked about a few years ago, and has so many advantages over our present foolish working hours that it is only to be wondered why it was not adopted? Is not the present a good opportunity for legislation to take advantage of the altered circumstances and to pass a Daylight Saving Act at once? What is the use of preaching economy unless it is practised?

* * * *

Apropos of the above is not the action of the Institution of Civil Engineers and the Town Planning Institute in changing their times of meeting to 5.30 p.m. and 6 p.m. respectively to be commended and is it not a change which would be welcomed by the members of other professional bodies? Is not a dismal discomfort experienced at present by every one who has to turn out into the darkened streets at the end of the meeting?

* * * *

Does it not seem rather extraordinary that, whereas (according to the recent presidential address to the Institution of Civil Engineers) there are no fewer than 3,500,000 acres of forest in Great Britain, the imports in one year of timber amount to the large amount of £36,000,000? When shall we have a Government that will teach the people of this country to make the best use they can of home products, instead of piling up gigantic debts to other countries?

* * * *

Was not the address of the president of the Royal Institution of British Architects a model of what a president's speech should be during the war? Was it not an example that might well be followed by other institutions and societies which have been surprisingly apathetic during this the greatest crisis in the history of our country? Who was responsible for that fateful cry of "Business as usual during the war," and to what extent has such a cry been detrimental to this country in putting out its best efforts?

* * * *

Was it not refreshing to find that upwards of £2,000 had been subscribed by members of this institution to various war relief funds, also that over 1,800 architects, including assistants, pupils and students, had joined His Majesty's Forces, and that many of these had been wounded or given up their lives for their country? As the president remarked towards the close of his stirring address: "After all, what is there really of importance except this great war?" Shall we not all heartily agree with him in this expression of feeling?

False Economy.—At the last meeting of Frome Urban District Council the surveyor, Mr. F. W. Jones, presented a report on the question of economy in regard to road maintenance. He stated it was only fair to everyone concerned to realise that a wrong interpretation might be put on the word "economy." Some people might think that a rigid cutting down of the stone allowance was economy, because for the time the stone bill was reduced. It must not be forgotten that for transit purposes the roads to-day were being used to relieve the congested state of the railways, and it was important that the main arteries at least should be kept up to bear this increased traffic.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. W. H. Matthews Jones, City Engineer and Surveyor, Chester.

President Elect—Mr. Henry C. Adams, M.Inst.C.E., M.I.Mech.E., F.R.San.I.

The seventh annual general meeting will be held in London on Saturday, November 27th.

Programme.

11.30 a.m.—Council meeting.

11.45 a.m.—Meet in the council chamber, No. 4 Southampton-row, W.C.

12 noon.—Annual general meeting.
Minutes of last meeting.
Presentation of annual report of council.
Announcement of result of ballot for election of council for the year 1915-16.
Installation of president.
Any other business.

1 p.m.—Adjourn for lunch.

2.30 p.m.—Reassemble in council chamber.

2.45 p.m.—Presidential address.
Discussion on the following papers to be presented to the meeting:—
"The Manufacture of Cement," by Horace Boot (past-president).
"The Benefits Derived by an Urban District Adopting a Town-planning Scheme," by W. L. Carr (member).

Advance copies of papers may be obtained on application to the secretary, and will be forwarded as soon as the papers are in print.

Ladies are invited to attend the meeting.

B. Wyand,
39 Victoria-street, S.W. *Secretary.*

INSTITUTION OF WATER ENGINEERS.

The twenty-fifth annual winter meeting will be held at the Geological Society's apartments, Burlington House, W., on Friday, December 10th, commencing at 2.30 p.m. A discussion will be invited on "The Necessity for Defining the Term 'Domestic Purposes' in General and Private Water Acts."

The election of the president and council for the year 1916-17, also the election of the auditors for the year 1916 will take place at this meeting.

Percy Griffith,
Secretary.

ROYAL SANITARY INSTITUTE.

[illegible] Bridge-[illegible] the Y[illegible] the Sanitary Institute, [illegible] Parkes Museum, [illegible] Buckingham Palace-road, S.W., on [illegible] Wednesday next, at 8 p.m., when a paper will be read by Mr. Arthur [illegible] works).

[illegible] Professor Percy Kerr-[illegible] Colonel R.A.M.C.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

ASSISTANT [illegible] Newcastle [illegible] Corporation [illegible] Borough Engineer, Newcastle-[illegible] Borough.

HIGHWAY SURVEYOR. Newcastle [illegible] District Council. £200 per annum. Mr. A. J. Bearcroft, clerk, Council Offices, Droitwich.

[illegible] Thakeham Rural District Council. 32s. per week.—Mr. Percy Ayling, clerk, Council Offices, Storrington, Sussex.

FIRE BRIGADE SUPERINTENDENT.—November 26th. Merton Urban District Council. £100—£140 per [illegible] Merton.

STEAM ROLLER DRIVER. Bromsgrove Rural District Council.—Mr. Chas. E. Cox, highway surveyor, Clent, near Stourbridge.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

[illegible] works, for the county council: (1) Tairgwarth new [illegible] County Hall, Cardiff.

SOUTHWARK.—November 16th (25th.—For pulling down and erecting two chimneys, for the board of guardians.—Mr. S. Wood, clerk, Guardians' Offices, Ufford-street, Blackfriars, S.E.

SHEFFIELD. November 17th. For the erection of 261 cottages, for the corporation.—Mr. F. E. P. Edwards, city architect, Town Hall.

ST. HELENS.—November 17th.—For the erection of an engine-house and other works, for the Electricity Committee.—Mr. E. M. Hollingsworth, borough electrical engineer.

KILKENNY.—November 30th.—For the construction of a reinforced-concrete bridge, for the Kilkenny and Wexford County Council. Mr. A. M. Burden, [illegible] Kilkenny.

Engineering: Iron and Steel.

MADRAS. December 15th. For the supply and delivery of 15-ft. diameter cast-iron wall sluices, with gun-metal faces, adjustable wedge blocks, pillars and headstocks, for the corporation.—Messrs. James Mansergh & Sons, agent, 5 Victoria-street, Westminster, S.W.

LONDON.—November 16th.—For the supply of [illegible] for the Commissioners of Works.—Controller of Supplies, Office of Works, 18 Queen Anne's-gate, Westminster, S.W.

WARRINGTON.—November 16th.—For the supply of extra high-tension cable, for the corporation.—Mr. F. V. L. Mathias, borough electrical and tramways engineer, Howley, Warrington.

MANCHESTER.—November 17th.—For the supply and erection of a turbo-alternator plant, and induced-draught plant, for the corporation. Mr. F. E. Heron, Electricity Department, Town Hall.

DUNDEE. November 23rd.—For the construction of [illegible] roof principal for the new city hall, for the corporation.—Mr. J. Thomson, city architect.

KIRKCALDY. November 24th. For supply of [illegible] cast-iron pipes and special castings, for the District Committee.—Messrs. J. & A. [illegible] Rent, 72a George-street, Edinburgh.

MANCHESTER. November 26th. For the supply and [illegible] of [illegible] heater to drying-rooms; also [illegible] Baguley automatic [illegible] drying-houses and steam heater, for the Sanitary Committee.—City Architect, Town Hall.

SALFORD. November 29th. For the supply of [illegible] steel [illegible] for the corporation. General Manager, Corporation Tramways, 32 Blackfriars-[illegible] Salford.

ATHENS.—December 17th—30th.—For the maintenance and working of the undertakings necessary for the water supply, and laying a distributing system.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

JOHANNESBURG.—December 30th.—For the supply and erection of ice-making and refrigerating plant, for the municipal council. — Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

Roads.

MANCHESTER. November 15th. For constructing [illegible] and gravel roads, for the Sanitary Committee.—City Architect, Town Hall.

LEWISHAM. November 17th. For making up Manwood-road, Crofton Park, for the borough council.—The Surveyor, Town Hall, Catford, S.E.

ROMFORD. November 23rd. For the supply of 550 tons of broken granite, for the urban district council.—The Surveyor, Council Offices, Market-place, Romford.

WARWICKSHIRE.—November 25th.—For the supply of road material, broken and unbroken, and tarred macadam, for the county council.—Mr. John Willmot, county surveyor, 6 Waterloo-street, Birmingham.

MERTON. November 26th. For the supply of broken granite, for the urban district council.—Mr. G. Jerram, surveyor, Council Offices, Kingston-road, Merton, S.W.

BRENTFORD. December 1th. For the supply of 200 yds. of blue Guernsey or other approved granite, for the urban district council.—Mr. J. W. Croxford, surveyor, Clifden House, Boston-road, Brentford.

GLANFORD BRIGG.—December 4th.—For making up certain streets and back roads, for the rural district council. Mr. W. H. Buttrick, engineer, High-[illegible] Scunthorpe.

CAMBRIDGESHIRE.—December 17th.—For the supply of broken granite, basalt and slag, for the county council.—Mr. H. H. Dunn, acting county surveyor, The County Hall, Cambridge.

Sanitary.

BROWNHILLS. November 15th. For laying stoneware pipe sewers and manholes, for the urban district council.—Mr. J. H. Shaw, engineer and surveyor, Brownhills, Staffs.

FLAXTON.—November 25th.—For removing and disposing of refuse in the village of Strensall, for the rural district council.—Mr. J. White, sanitary inspector, 4 New-street, York.

CHEPPING WYCOMBE.—December 6th.—For the supply of stoneware pipes, for the corporation.—Mr. T. J. Rushbrooke, borough surveyor.

Stores.

BRISTOL.—November 15th.—For the supply of materials, for the Sanitary and Improvement Committee.—City Engineer, 63 Queen-square, Bristol.

FELLING.—November 20th.—For the supply of macadam, Heworth freestone kerb and setts, whinstone kerb and setts, Portland cement, shovels, brooms, sanitary pipes, and cartage, for the urban district council.—Mr. R. Hall, clerk, Council Buildings, Felling-on-Tyne.

WEST HARTLEPOOL.—November 20th.—For the supply of road, sanitary and other materials, for the

corporation. Mr. F. Dennis, borough engineer and surveyor.

CHATHAM. November 24th. For the supply of coals and materials, for the corporation. Borough Surveyor, Town Hall.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.
‡ Provisionally accepted.

ALDERSHOT.—For the supply of 500 tons of Clee Hill, Devon or North Wales basalt, and 200 tons of tar-macadam. Mr. F. C. Uren, surveyor:

TAR-MACADAM.

Pwllheli Granite Company.—2½ in., £1 3s. 6d.; 1½ in., £1 3s.
Abdon Clee Stone Quarries, Limited 2½ in., £1 2s. 10d.; 1½ in., £1 1s. 10d.
Northern Quarries Company, Limited 2½ in., £1 1s. 9d.; 1½ in., £1 2s. 3d.
J. Wainwright & Co.—2½ in., 18s. 9d.; 1½ in., 19s.; slag dust, 15s. 3d.
Cwmavon Slag Company 2½ in., 1½ in., and ¾ in., 18s. 3d.
J. Smart & Son. 1½ in. and 2½ in., 18s.
W. Prestwick & Sons.—Bottoming, 18s.; topping, 19s. 6d.
Tarmac, Limited 1½ in. and 2½ in., 17s. 7d.†
Mendip Granite and Asphalte Company 1½ in. and 2½ in., 15s. 8d.

GRANITE.

J. Mowlem & Co., Limited.—Guernsey, 2 in., £1 0s. 9d.
A. & F. Manuelle, Guernsey, 2 in., £1.
Brookes, Limited.—Guernsey, 2 in., 19s. 9d.
B. J. Forder & Son, Limited.—Derbyshire, 2 in., 17s. 5d.
Pwllheli Granite Company North Wales, 2 in., 17s.
Festiniog Granite Company.—North Wales, 2 in., 16s. 11d.
Johnson Brothers Breedon Hill, North Wales, 2 in., 16s.
Tegid Valley Company, Devon, 2 in., 15s. 10d.
Johnston Brothers, Cefn-y-Wern, North Wales, 2 in., 15s. 5d.; Blodwell, North Wales, 2 in., 15s. 6d.; Granham Moor, Shropshire, 2 in., 14s. 10d.
Field & Mackay.—Littlestone, Clee Hill, 2 in., 14s. 7d.
British Macadam, Limited.—Clee Hill, 2 in., 14s. 7d.†
Abdon Clee Stone Company.—Clee Hill, 2 in., 14s. 7d.
H. Cooper & Co.—Clee Hill, 2 in., 14s. 7d.
Roadstone Supply Company.—Moors Hill, 2½ in., 13s.†

LONDON.—For the provision of heating and ventilating installation at the central car repair depot, for the London County Council:

E. Deane & Beal, Limited, Monument-street, E.C.	£1,890
Bright-side Foundry and Engineering Company, Limited, Camberwell, S.E.	1,819
W. G. Cannon & Sons, Limited Southwark, S.E.	1,780
Young, Austen & Young, Leicester	1,671
J. & E. May, Lincoln's Inn-fields, W.C.	1,597
Colley, Meikle & Co., Southampton-row, W.C.‡	1,495

Architect's estimate £1,750.

MALDON.—For providing and laying cast-iron water main, for the corporation.—Mr. T. R. Swales, borough engineer:—

H. Lacy, Limited, London, S.W.	£269
Spalding, Sons & Co., Heybridge, Essex	175
W. Jackson, London, E.	160
Emery & Co., Birmingham*	144

RATHMINES.—Accepted for the supply of a motor generator, for the urban district council:—

British Thomson-Houston Company, Rugby, £108.

ROMFORD.—For the supply of granite, for the rural district council.—The Highway Surveyor:—

W. Griffiths & Co., London, E.C., 842 tons, 1 in., 1612, 701 tons, 1½ in., £554; 125 tons, ¾ in., £69.*

WANDSWORTH.—For surface-water drainage works at the cemetery, for the borough council.—Mr. P. Dodd, borough engineer:

S. Lane, £710.†

WIGAN.—For painting and repairs, for the corporation.—Mr. A. T. Gooseman, borough engineer:—

Painting.—T. Leyland, Wigan, £39.
Pointing and Repairs.—Fairhurst Brothers, Wigan, £69.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

NOVEMBER.

12.—Royal Sanitary Institute: Meeting at Ripon. Mr. A. W. Smith on "The Construction and Working of the New Camp Sewage Works."
17.—Chadwick Public Lecture: Mr. W. E. Riley on "Some Conclusions on Housing our Workers." Royal Sanitary Institute. 8.15 p.m.
18.—Institution of Electrical Engineers: Mr. Charles P. Sparks delivers his presidential address; presentation of premiums. 8 p.m.
27.—Institution of Municipal Engineers: Annual General Meeting in London.

DECEMBER.

1.—Institute of Sanitary Engineers: Dr. W. E. Adeney on "The Disposal of Sewage by Dilution: A Bio-Chemical Method."
10.—Institution of Water Engineers: Annual Winter Meeting, Burlington House, W. 2.30 p.m.

APPOINTMENTS OPEN.

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BROMSGROVE RURAL DISTRICT COUNCIL.

STEAM ROLLER DRIVER.

The above Council invite applications for the appointment of Driver of Steam Road Roller.

Applications, stating age, experience, and wages required, accompanied by copies of two recent testimonials, to be sent to the undersigned.

CHAS. E. COX,
Highway Surveyor.

Surveyor's Office,
Clent, near Stourbridge.
November 9, 1915. (2,760)

TENDERS WANTED.

WARWICKSHIRE COUNTY COUNCIL.

MAIN ROAD MATERIAL.

The Council are prepared to receive Tenders for the Supply of Road Material (Broken and Unbroken), also Tarred Macadam, delivered at the various Railway Stations and Wharves in the County.

Sealed Tenders (on Forms to be obtained from the County Surveyor), addressed "Tenders for Road Material," must be delivered or sent to the undermentioned on or before Thursday, the 25th day of November, 1915.

The Council do not bind themselves to accept the lowest or any Tender.

Any further information can be obtained from

JOHN WILLMOT,
County Surveyor.

6, Waterloo-street, Birmingham. (2,761)

APPOINTMENTS WANTED.

GENERAL ASSISTANT (Municipal Engineering) seeks re-engagement; 14 years' experience in Provincial Office (pop. 125,000), in all branches. Beyond Military age. — Box 1,544, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (2,757)

MISCELLANEOUS.

THEODOLITE, large transit, practically new, for sale. Figure 32 Troughton & Simms' catalogue. Cost £90; will accept Fifty-five Guineas. Bargain.—Apply Currall, Lewis & Martin, Limited, Contractors, Birmingham. (2,759)

GALVANISED BARBED WIRE available from London stock. Large quantities 2 point, Barbs 5 in. to 6 in. apart, 12½ gauge thick.—Apply Metal and Hardware Products, Limited, 104 High Holborn, London. (2,749)

BLAST FURNACE SLAG
From 14 cwt. to 24 cwt. per cubic yard

FOR TAR MACADAM

Old, Hard, Dense.
Made Fifty Years.

JOHN FREAKLEY & CO., Ltd., Coneygre Slag Works, DUDLEY PORT, TIPTON.
Telegrams—"Freakley, Tipton." Telephone—No. 3 Tipton.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. NOVEMBER 19, 1915. No. 1,244.

Minutes of Proceedings.

A Growing Risk.

It is not long since the pollution of water by sewage was looked upon as equivalent to infection with disease germs. Recent experience and research work, however, tend to shew that unless disease germs are present in the sewage it is by no means certain that sewage pollution will necessarily produce disease. Further, it is clear that the natural purifying agencies in a clean river or in a large storage reservoir of any kind tend to get rid of the disease germs quickly. Accepting this very comfortable theory, we are apt to overlook the chief cause of our present immunity. Fifty years ago or less it is probable that the sewage of [illegible] contained many more disease germs than it does at present. Typhoid, for instance, is a preventable disease, and, owing to a variety of causes, the disease rate has fallen greatly. In former times there must have been many more typhoid carriers about, and thus where sewage polluted the water the effect must have [illegible] supplies being of a more primitive character, with less protection provided for the consumer, the latter was then more likely to suffer from typhoid fever than now; in fact, a vicious circle was established. With great care and with enormous expense we have produced a better condition of affairs, and the typhoid and other disease rates have fallen in such a manner that the chances of an epidemic have been reduced to a minimum in most places.

This was before the war. We are now reaching a condition, however, which must cause the most grave anxiety to all who are interested in matters of public health. In the first place the medical officer, the medical practitioner, and the skilled nurse have in many cases been called away for active service with our armies. This is an important factor which should not be overlooked, but the most important fact, and one which affects the water engineer vitally, is that all over the country new camps, munition works, hospitals, and settlements of all kinds are springing up. The populations of small and sometimes undrained places are suddenly increased by thousands, and though elaborate drainage and sewage purification works are sometimes established, this is not always the case, and an enormous amount of pollution must of necessity be entering our rivers and sources of supply. Further, war economy, and the fact that the Treasury has cut off supplies for ordinary municipal loans for drainage work are calculated to produce trouble; at any rate it does not assist the engineer in dealing with the problem presented when the sewage of hospitals pollutes a river or when the flow to a disposal works is suddenly doubled by the advent of a military population. The country is, moreover, full of wounded soldiers, British and foreign, and the chances of pollution with disease germs must thereby be increased.

As yet, happily, no serious results appear to have been caused, or at any rate they have not been reported. We are reaping the good results of better sanitary conditions in the past and of the scientific skill brought into play in connection with the health of armies in the field and at home. We are, however, undoubtedly rapidly producing in this country a state of things which may be inevitable, but which is against all sanitary laws. We are providing the means by which the disease organisms may be distributed wholesale. We are in the condition of the town which for many years drank a polluted water without apparent ill effects. Such a town merely waited for the introduction of the disease germ, the means for its distribution existing. As soon as the germ appeared it was rapidly distributed, and a serious epidemic was the result. If once cholera or typhoid started in this country to-day it might be found far more difficult to stop its spreading than would have been the case before the war. The efficient purification of the sewage from the camps, hospitals, munition settlements, and so forth is, of course, desirable, but is practically impossible without delay. However, the vigorous examination of all water supplied to consumers is possible, and its perfect purification may be easily effected. It is therefore a matter of the gravest importance that all supplies should be kept under close scientific inspection, and that there should be no slackness in adopting whatever method of purification may be necessary. Where this is not done the ordinary standards may easily prove to be misleading. The coli present in a moorland supply may be negligible till a camp is established, or those in a chalk supply may be un-

important till sewage irrigates its gathering area.

* * *

Housing in Birmingham.

Although the paper which was read by Mr. Charles Wareing at a recent sessional meeting of the Birmingham and Midland Centre of the Institute of Sanitary Engineers was primarily concerned with a consideration of the housing problem as it exists in the great Midland city, it also contained a most interesting historical summary of housing and sanitary legislation. The problem of providing sanitary homes for the poor and working classes of this country has occupied the attention of politicians and social workers for the past sixty years. During this period about fifty Acts of Parliament have been passed with a view to providing a solution. In 1842 a Royal Commission was appointed to enquire into the condition of the housing of the poor. The evidence gathered by this commission revealed the appalling conditions under which the poor lived, and the outcome of the inquiry was the passing of the Public Health Act in 1848. In 1851 the Common Lodging Houses Act and the Lodging Houses Act, which gave local authorities powers to erect lodging houses at their own expense, were passed. Then followed in 1868 what are known as Shaftesbury's, Torren's and Cross's Acts, which were supplemented by the Artisans' Dwellings Act in 1875. This Act gave powers for slum clearance and rebuilding, under powers of compulsory purchase, but schemes carried out under it required the assent of Parliament, and the procedure was costly and complicated. A Housing of the Working Classes Act was passed in 1885, and under it some real attempts were made to put an end to insanitary dwellings, of which, at this time, many could be found in all our large towns. But it was not until 1890 that the law relating to housing was consolidated in the Housing of the Working Classes Act. This Act, which is adoptive, forms the principal housing Act under which most of the municipal housing has been carried out. Finally, the Housing, Town Planning, &c., Act of 1909, Part I. of which forms part of the Housing of the Working Classes Acts from 1890, makes many amendments which simplify the procedure necessary under the earlier Acts.

Much good work has been accomplished at Birmingham under these and certain local Acts, but difficulty arises in connection with the making of closing orders owing to the shortage of accommodation for rehousing purposes. Mr. Wareing's experience leads him to advocate the erection of municipal cottages in the suburbs, and he ventures the opinion that a scheme could be made self-supporting if carefully carried out. Birmingham's real need, he says, is not for a central housing scheme, but for cottages near to where the low-paid workers are employed, and far enough away from factories to be clear of the smoke and other drawbacks associated with town dwellings. Incidentally, we observe that Mr. Wareing's views in regard to back-to-back houses—of which there are about 40,000 in Birmingham—are not quite orthodox. He thinks they should not be condemned too readily, but that it is possible to ventilate them if provided with suitable windows to open and flues to each room. Much must, however, depend upon the habits of the tenants.

* * *

The Rural Road Surveyor.

In these columns expression has often been given to the legitimate grievances of rural road surveyors both in regard to salary and conditions of service. There are no doubt some districts in which there is little or no cause for complaint, but in many cases these officers are not only grossly underpaid, but they are set an impossible task in regard to the large mileage of roads for which they are responsible. Moreover, it is no uncommon thing for them to have to provide their own means of conveyance, office, stationery, and staff, if any assistance is found to be necessary. These grievances were voiced once more in a paper which was read at a recent meeting of the Wiltshire Surveyors' Association by Mr. J. W. Brooke, the surveyor to the Marlborough Rural District Council. Mr. Brooke suggested—and with every show of reason—that the surveyor should at least be provided with an office boy in order that he may be released as much as possible for his outdoor work; that he should be allowed a reasonable sum in respect of his travelling expenses; and last, but not least, that, being unable to make any provision for old age out of the usual small salary, he should be entitled to a pension allowance.

Mr. Brooke comes of a family of road surveyors, and the earlier part of his address, which was of a personal nature, was of considerable interest, inasmuch as his grandfather was a pupil of the great Macadam. Mr. Brooke proceeded to trace the effect of the development of highway administration on the practical work of road making and maintenance from the time of the annually elected surveyor to the present day, and expressed the opinion that, although the march of progress has undoubtedly been good for the roads, it has not improved the position of the surveyor. Not the least interesting part of the paper was that which dealt with the effect of moisture on the ordinary macadamised road. In the Marlborough Rural District considerable difficulty has been experienced in connection with intermittent springs occurring in the chalk substratum. These break out in quite unexpected places, and in bad cases may completely destroy a length of road. Some compensation for this, however, is to be found in the plentiful supply of flints, which is yielded by the geological formation of the district. Mr. Brooke submitted with the paper a number of very interesting specimens from his museum, showing sponges, fossils, and other curious formations.

* * *

Standardisation of Statistics.

In almost every branch of engineering practice there are being constantly compiled statistics of various kinds, the general utility of which would be greatly enhanced if they were prepared upon some uniform plan so as to be easily comparable. We observe with satisfaction that this subject has been under consideration by the Standardisation Committee of the Institution of Municipal and County Engineers, and that a resolution has been passed that a list of subjects in respect of which it is desirable to prepare standard forms for statistics be circulated among the members of the committee for consideration at the next meeting. The desirability of uniform statistics was also emphasised recently at the Pan-American Road Congress, the reader of one of the papers pointing out that continued neglect to procure the collection and collation of uniform highway statistics must result in waste of experience, energy, and resources. In the absence of standard forms many engineering departments may do similar work without any basis for comparison. The records of one are unintelligible to others. Mistakes made in one department are duplicated by many another. Experiments are repeated, often with unsatisfactory or disastrous results, in a dozen different places. Every department, every engineer has to learn largely through his own experience, and when this process involves the huge sums now being expended it is altogether too costly. Were comparative statistics available, every department would be an experiment station; every experiment station an illumination

to the whole field. The conscientious engineer, consulting such statistics upon the inception of [illegible] work, could determine, far more accurately than he can to-day, the measure of success or failure in it.

A Dundee Sanitary Appointment.

The multitude of counsellors in whom there is said to be wisdom are sometimes hard to please. The Dundee Public Health Committee, in a fit of abnegation that would have been praiseworthy had the sequel been otherwise than it is, gave authority to the chief sanitary inspector to fill a vacancy in his staff, and Mr. Bridham, whom a trusted as well as an experienced officer, proceeded to carry out this behest to the best of his ability. He nominated a certain assistant as the man best fitted to fill the post. There, of course, the matter ought to have ended, and it would have ended but for the fact that the nomination did not happen to square with the views of certain members of the Health Committee. At a recent meeting of this body the question whether the chief inspector's nomination should be confirmed was raised, and true to the instincts of councillors when the personal factor is at issue, the discussion became what the local paper describes as a wrangle. Eventually the consideration of the matter was postponed, and it is obvious that a somewhat deplorable position will be reached unless a way is found out of the difficulty that will secure the authority of the chief inspector in his department. For this, after all, is an important thing that is not to be overlooked. It seems to us that the Public Health Committee should either have retained the power of appointing in its own hands, or, having delegated authority to the chief officer, it should abide loyally by the compact thus made. To request an officer to make a selection and afterwards subject his decision to revision, accompanied by wrangling, is manifestly destructive alike of his dignity and authority.

* *

Highway Improvement in the United States.

We have received a copy of a very interesting circular recently issued by the United States Department of Agriculture, in which the expenditures on highway improvement in the several States of the Union are compared and analysed. Having regard to the great economic importance of efficient internal communication in a new or developing country, it is not surprising to learn that during the past twenty years the various State governments have been active in a constantly increasing measure in behalf of road improvement. During that period the total expenditure from the State Legislatures has been approximately £42,400,000, and with these funds nearly 36,000 miles of improved roads have been constructed. The circular is largely tabular in form so as to show at a glance what has been accomplished by each State. It occurs to us as being wise on the part of the central authority to present the information in this form, introducing as it does at once a certain element of competition—or at least of comparison. It is interesting to observe that, although substantial contributions are made by the States—there being only four in which there is no State-aid law—by far the greater part of the money has been provided by local funds raised by counties, townships, and districts. The circular contains three tabular statements, which show respectively an analysis of the State highway expenditures, the distribution of such expenditures under State control, and the mileage of highways in the various States. The last-mentioned shows that the percentage of surfaced roads varies from 0·3 in Nebraska and North Dakota to 58·8 in Rhode Island.

War-time Economy.

The subject of war-time economy continues to receive attention at the hands of municipal engineers. Following the appearance of the special article contributed to these columns by Mr. W. H. Maxwell, the borough engineer of Tunbridge Wells, on September 3rd last, the question, it will be remembered, was dealt with at some length in the paper read by Mr. S. S. Heywood, the borough engineer of Brighouse, at the meeting of the Institution of Municipal and County Engineers held in that town last month. This week we give the concluding instalment of a paper which was read by Mr. Edward Willis, the engineer and surveyor to the Chiswick Urban District Council, at a recent meeting of the Lower Thames Valley District Surveyors' Association, and in which many valuable suggestions for effecting savings in the spending departments of public bodies are made. Another contribution to the literature on the subject is now promised by Mr. William H. Eley, the surveyor to the Newmarket Urban District Council, on the occasion of the forthcoming Eastern Sub-District meeting of the Institution of Municipal and County Engineers at Bury St. Edmunds, announced elsewhere in this issue, and it seems not unlikely that the topic—undeniably important at the present moment—will provide food for discussion for some considerable time to come.

* *

Hedge Trimming.

The overgrown hedge and the tree which overhangs a highway are alike dangerous to the traffic which may be passing along it. This is particularly the case at the present time, when roads are not only darkened to an exceptional degree, but are also being used considerably for the purposes of military traffic at night. We therefore thoroughly endorse the plea put forward in another column by Mr. Wallace Riche, the secretary of the Roads Improvement Association, for a general hedge trimming and tree pruning. The points of special danger are corners and junctions where an obstructed view may so easily lead to disaster. In not a few instances these dangers to the public are suffered to continue entirely because of a little want of thought on the part of those owners or occupiers on whose land the offending hedges or trees may be growing, and in such cases the Roads Improvement Association is often able to procure the desired result by tactfully reminding them of the desirability in the public interest of trimming or pruning. Any of our readers who may be acquainted with any places rendered dangerous by overgrowing trees or shrubs are invited to send full details to Mr. Riche, when the matter will be carefully investigated and such action as may appear desirable will be taken to remove any danger.

Local Administration in the Metropolitan Area.—In the House of Commons on the 4th inst. the Chancellor of the Exchequer was asked whether the cost and expenditure of public authorities in the Metropolitan area was the most costly in the kingdom per head of population; and whether, in view of the necessity for economy owing to the war, he could take any steps, by legislation or otherwise, for the curtailment of expenditure which was due to overlapping services among such public authorities. Mr. Hayes Fisher, who replied, said local administration in the Metropolis was, no doubt, somewhat costly compared with that of provincial boroughs, but his hon. friend was aware that there were many reasons why no fair comparison could be made. He might observe that census population was not a very proper basis of comparison between London and other districts, as it left out of account the very large day population. As his hon. friend knew, such overlapping as existed was due to the way in which local government in London had developed. Legislation would be necessary to alter the present system of administration, and this could not fail to be contentious.

The Construction and Working of the Royal Military Camp Sewage Disposal Works at Ripon.*

By ARTHUR W. SMITH, Manager.

One notable outcome of the war has been the unusual sight of military encampments which have arisen in various parts of the country, where the training, equipment, and housing of recruits for the Army could be expeditiously and thoroughly effected.

The search for suitable sites for these purposes must have imposed a difficult task upon the military authorities and their advisers, but an inspection such as will be afforded of the configuration of the land and other practical features associated with the undertaking at Ripon will surely reveal justification for the selection which has been made.

Immediately the locality was determined upon very early in this year, the question of what sanitary provision should be made became pressing; and it is pleasing to record that in this case there has been happy and highly successful co-operation between the War Office representatives and the profession of civil engineering, whereby the distinguished services of Mr. E. J. Silcock, M.INST.C.E., F.S.I., F.G.S., of Westminster and Leeds, were secured to provide solutions to the problems involved.

The schemes he propounded at remarkably short notice, and saw carried out to a successful conclusion, embraced main outfall sewer, branch sewers and drains, the sewage purification works, and the sanitary water supply.

To fully appreciate the nature and extent of the disposal works it is necessary to outline the proposals comprising these projects.

The camp occupies an area of about 1,080 acres, and is designed to provide accommodation for a complete army corps of 42,000 men with 10,000 horses, and a large military hospital for general purposes, together with an infectious diseases hospital.

The water-carriage system of sewerage is adopted, and nearly all surface water is excluded from the sewers.

The sewage is collected by a system of sewers and drains, and conveyed to a site adjoining the existing Ripon Corporation sewage farm, where the sewage of Ripon city is also connected to the new bacterial sewage disposal works to treat the sewage of camp and city.

The main outfall sewer is 3 miles in length, and is constructed at such levels that it is kept for the most part above saturation level of the gravel subsoil. This involved carrying the sewer across the rivers Skell and Laver by elevated pipes. Owing to the canal, part of the outfall sewer is an inverted syphon.

The other sewers in the camp, about 14 miles in length, radiate from the outfall sewer, and the drain connections are about 31 miles in length, making a total length of sewers and drains of 48 miles.

The water supply of the camp is provided from two sources, with separate systems of pipes. The water used for drinking, cooking, washing, and other purely domestic purposes is supplied from the waterworks of the Corporations of Ripon and Harrogate. The water used for sanitary purposes, fire service, horses, and vehicle washing is pumped from the rivers Skell and Ure.

It was expected that the water consumed would be 500,000 gallons per day, made up as follows: Officers, 15 gallons per head per day; men, 8 gallons per head per day; horses, 10 gallons per head per day; and that the sewage from the camp would be of a very strong character. It was for the purpose of diluting this very strong sewage with the weak city sewage that suggested the idea of treating both sewages together. The city sewers take in a good deal of subsoil water, and it was intended to take as much sewage from the city as would make the total flow 1,000,000 gallons per day.

Experience has shown that the consumption of water in the camp exceeds the estimate, and amounts to about 700,000 gallons when the camp is fully occupied.

ENGINEERING DETAILS.

The sewage disposal works consist of two screening tanks, four deep and four long subsidence tanks—the deep tanks being on the Dortmund principle, the long tanks having floors with a back fall to the sludge pipes. The total tank capacity is 500,000 gallons, and the system is one of continuous flow.

The percolating bacteria bed is rectangular in shape, 10,000 sq. yds. in area, the filtering media 6 ft. deep, consisting principally of slag, with a proportion of local gravel. The floor is sectionised and graded to discharge into sixteen channels, and is covered with Naylor's tiles.

The bed is surrounded with honeycombed brick walls, faced with blue bricks, strengthened by counterforts, and finished with slag-concrete coping.

The sewage is distributed on the bed by eight "Simplex" reciprocating sprinklers, supplied and fixed by Messrs. Ames-Crosta Sanitary Engineering Company. These sprinklers operate on four troughs carried on iron columns; are actuated by slight head of liquid, each to travel 150 ft. by 75 ft. wide, capable of distributing 2,600 gallons of sewage per minute, travelling at the rate of 30 ft. per minute. These machines are ingenious in construction, simple, easy, and reliable in working; and by the provision of travelling buffers, situated at the centre of the bed, there is no space left, as is usually the case at this point, untouched by the sewage, thus utilising the beds to the fullest capacity.

The effluent from the bed is conveyed to three humus tanks, also formed on the Dortmund principle, the final effluent being discharged into the river Ure.

The arrangements for removing deposits from the whole of the tanks are very complete. A system of suction pipes is laid with connections to every compartment, and the sludge is pumped by means of Stereophagus pumps (supplied by Hathorn Davey & Co., of Leeds, driven by oil engines manufactured by the National Gas Engine Company) to six large sludge drying beds, specially underdrained and prepared with 1 ft. thickness of filtering media.

All the tanks are of concrete construction throughout, and the walls are finished with artificial stone coping, made on the works of local gravel and sand.

The sewage is pumped through a 12-in. cast-iron rising main from the Ripon city works by two Stereophagus pumps, manufactured by the Pulsometer Engineering Company, Reading, driven by oil engines made by the National Gas Engine Company.

Owing to the presence of a large quantity of grease in the camp sewage there was, in the early stages of working, considerable interference with the distribution of sewage from the sprinkler arms, and to prevent the choking of the pipes grease baskets have been placed in the main channel between the tanks and the percolating bed, and have answered the purpose most satisfactorily.

There is nothing of an elaborate nature about the work, and no expenditure has been incurred which is not actually necessary.

Speed, in the preparation of the schemes and in carrying out works of construction, has been the dominating factor, and in the case of the main outfall sewer and the sewage disposal works it has been literally a race against time.

Work was commenced at the end of March, and by the latter part of July a portion of the tanks and a section of the bed was ready to treat sewage, ten days before the main sewer was put into operation by camp sewage. The remainder of the tanks, beds, and pumping stations were fully completed by September 1st, and it is claimed that the short period occupied by construction constitutes a record.

This result was only achieved by continued and strenuous application on the part of those most closely concerned, and having recourse to night, Saturday, and Sunday work for fully two months of the period named. As the bulk of the media was imported, transport difficulties arose, and in addition to the haulage by night and day from the railway station, a light railway was constructed from the works across country to the camp sidings at Littlethorpe, 1½ miles away.

The contractors for the whole of the deep tanks were also confronted with adverse conditions in the shape of water and bad ground, and constant pumping was necessary pending the piling, staging, and concreting to above water level.

Considering that the tanks and beds were put into

* Paper read at a Provincial Sessional meeting of the Royal Sanitary Institute held at Ripon last Friday.

[illegible] most gratifying to note that analyses of the final effluent show that the works are thoroughly efficient, and are capable of producing an effluent of a high degree of purity.

The final accounts of the cost have not yet been settled, but approximately the disposal works have cost £30,000; the sewers and drains, £46,000; total, £76,000.

For sewers and drains for 42,000 persons, and disposal works for a population of over 50,000, this may be claimed as an economical result.

The contractors for the tanks, sludge beds, pumping mains and drains were Messrs. Edwards & Co. (Doncaster), and Messrs. Ward & Tetley (Bradford); and for the bacteria beds, Messrs. Arnold & Son, of Doncaster.

MILITARY EMERGENCY HOSPITAL CONSTRUCTION.

By A. Saxon Snell, F.R.I.B.A., F.R.S.A.N.I.

[Chadwick public lecture delivered at the Royal Society of Medicine, Wimpole-street, Cavendish-square, W., on the 10th inst., Mr. John Slater, F.R.I.B.A., occupying the chair.]

To meet the emergency of war, the War Office has always reckoned upon making use of spare accommodation in voluntary and public hospitals and infirmaries, and, of course, in its own Service hospitals. In addition to these, arrangements have been made for requisitioning a large number of public buildings, schools, &c., for conversion as temporary hospitals. Other countries have made similar arrangements, and it is quite in accord with their policy of thoroughness that the Germans have, in many of their public schools, made special arrangements for converting them into hospitals. In addition to the conversion of existing buildings, the War Office has also contemplated the erection of temporary emergency hospitals, for which purpose detailed plans have long since been prepared. Such buildings could be erected at short notice, very quickly, and at small cost.

The scale of the present war is so large that many civil architects have been called in to assist the War Office in carrying out temporary hospital schemes. It was inevitable, however, that many of the plans show considerable variation from the War Office model, both as regards planning and construction, although, of course, in every case, such plans had to be submitted to and approved by the War Office. The variation in planning is instructive and interesting.

One of the first of these hospitals was the First Eastern Hospital at Cambridge, which is remarkable for being designed upon the open-air principle. It [illegible] those who initiated it. It was designed and carried out by Mr. Chas. Skipper, of Cambridge.

Open-air wards for use both in winter and summer are by no means new in this country. For instance, Dr. Philip Boobbyer, medical officer of health at Nottingham, has had several in his district for a number of years. In these every kind of disease has been treated (not excluding pneumonia), winter and summer.

The value of roughly improvised buildings and sheds, which are practically open-air, is referred to by Miss Nightingale, Dr. Brocklesby, Sir John Pringle, and, as far back as 1758, by Dr. Guy.

The nucleus of these temporary hospitals is generally an existing hospital or a house, the permanent buildings of which are of considerable value as administrative offices or staff quarters.

Methods of construction vary. The War Office model plans provide for a framing of timber, lined on the inside with plaster slabs and on the outside with corrugated iron; roofs are also finished with corrugated iron.

Timber framing lined inside and out with asbestos sheets is another method of construction, and these buildings are more sightly and no less fire-resisting. Ruberoid is used on the roofs. The flooring is of tongued boards and wood joists. At Leicester the walls are of brick, and the floors cement. At Shorncliffe Mr. White has covered his floors with linoleum, than which there is no more satisfactory ward floor.

Heating in closed wards is generally by means of steam pipes and radiators. At Shorncliffe anthracite stoves are used. In open-air wards no heating whatever is provided. Nevertheless, a few open fires are desirable, and in the later buildings at Leicester Mr. Perkins Pick has provided one at the end of each ward in a partly enclosed day-room. They are appreciated for the appearance of comfort, and they provide also for the nurses some means of warming their hands previous to changing dressings, &c.

Electric lighting is general throughout.

In these buildings it is not usual to observe any meticulous care in the rounding of internal angles and in the avoidance of dust ledges. Even the sinks and lavatories are generally supported on rough wood frames.

The buildings are, of course, meant to be temporary, built quickly, and at very small cost, and these matters are incompatible with refinement in detail. Nevertheless, these refinements cannot safely be, and are not, ignored for isolation hospitals and in operating theatres.

One matter—and it can scarcely be called a refinement—is rather generally ignored—*i.e.*, a layer of concrete over the whole surface of the ground of the building. It may be of less importance if the building is raised a few feet above the ground, so as to provide a clear sweep for the air; otherwise, especially in enclosed wards, ground air is bound to find its way upwards, and the quality of ground air is variable, and not to be ignored with impunity.

The cost of these buildings varies greatly. The War Office model plan is estimated to cost between £60 and £70 per bed, but the Cambridge, Canadian and Glasgow Hospitals cost about £25 per bed. At Leicester the ward blocks only were estimated at the cost of £15 10s. per bed.

WILTSHIRE SURVEYORS' ASSOCIATION.

The council of this association held a meeting at the Town Hall, Trowbridge, on the 30th ult. Mr. W. H. Stanley, chairman of council, presided, and there were also present Messrs. J. George Powell (county surveyor), president of the association, A. E. Adams (Chippenham), J. W. Brooke (Marlborough), F. G. Billingham (Devizes), C. Bowman (Malmesbury), A. O. Crew (Devizes), C. G. M. Cross (Westbury), T. B. Draper (Trowbridge), G. Drewitt (Calne), J. Godfrey (Calne), H. J. Godfrey (Wootton Bassett), C. C. Hancock (Warminster), C. K. Henderson (Pewsey), A. H. Lapham (Chippenham), H. G. Nicholson-Lailey (Trowbridge), W. H. Lintern (Malmesbury), A. F. Long (Warminster), R. B. Lees (Bradford-on-Avon), S. W. Saunders (Devizes), and E. Plummer Davies (hon. secretary).

Mr. Stanley announced that, as a result of the ballot for the election of president, council, and officers for the year, the whole of the council had been elected *en bloc*. Mr. W. H. Stanley was re-elected chairman of the council, and Mr. E. Plummer Davies was re-elected as honorary secretary. Messrs. Nicholson Lailey and Stanley were elected as hon. auditors.

RE-ELECTION OF PRESIDENT.

At the annual meeting of the association which was held subsequently, Mr. Stanley announced that Mr. J. George Powell, county surveyor of Wiltshire, had been unanimously re-elected as president.

Mr. Powell, who thereupon took the chair, thanked the members for the renewal of their confidence and briefly reviewed the past year's work of the association. He referred to the great necessity of all surveyors studying economy during the present crisis, and expressed a wish that in the county of Wilts surveyors would use the greatest economy in maintenance of main roads, either by refraining from recoating the surfaces of the roads unless it was absolutely imperative, or by using wherever necessary a cheaper class of material for the time being.

A letter was received from Mr. Parker Pearson, borough surveyor of Marlborough, resigning his membership of the association owing to his having taken up another appointment. The resignation was received with regret, the association congratulating Mr. Pearson on obtaining a better appointment.

Upon the invitation of Mr. J. W. Brooke, it was decided to hold the next meeting of the association at Marlborough in April of next year.

A paper upon road construction in Wiltshire—reproduced elsewhere in this issue—was read by Mr. J. W. Brooke, of Marlborough.

A discussion ensued, opened by Mr. W. H. Stanley, and a vote of thanks was passed to Mr. Brooke and to Messrs. Lailey and Stanley for making the arrangements for the meeting.

SEWAGE SYPHONS.

RIVER CROSSING AT FYE BRIDGE, NORWICH.

By Arthur E. Collins, M.Inst.C.E., City Engineer.

[The following article, together with the drawings which accompany it, have been very kindly furnished by Mr. Arthur E. Collins, the city engineer of Norwich, in amplification of his criticism of the answer to question 503 in the "Assistants' and Students' Section," which appeared in our issue of October 15th. Mr. Collins' original comments appeared under the heading of "Notes" in the "Assistants' and Students' Section" the following week.]

I have had my drawings of river crossing at Fye Bridge put into diagrammatic form, and forward a copy herewith. I think this drawing is quite self-explanatory. There are special circumstances in connection with this case. For instance, I have a low-level sewer into which I can discharge the 24-in. gravitating sewer in the event of having to obtain access to the interior of the inverted syphon; but I have not needed to take advantage of this. Then, again, I have air at 20 lb. pressure available for disturbing the flow in the syphon, but its use has not been found necessary. At a convenient point on the gravitating sewer, upstream of the inverted syphon, I was able to collect sewage into a 3,000-gallon Shone automatic flushing tank, which has been effectual in keeping the arrangement continuously at work.

This inverted syphon forms part of a sewage sewer which is not affected considerably by rainstorms. Had I to deal with an ordinary combined sewer conveying up to six times the daily dry-weather flow, and where the overflow of a noticeable quantity of undiluted crude sewage was prohibited (in the unlikely event of the syphon being blocked), I should lay two pipes—

(1) Capable of carrying the maximum dry-weather flow in any half hour.

(2) Six times the maximum daily dry-weather flow.

I should place the inlets so that the sewer arranged for the maximum dry-weather flow was working to its full capacity before any flow took place through the other one.

My reason for duplicating in this case is the obvious one of ensuring self-cleansing velocities sometimes daily.

In 1889, on a 9-in. sewer, at a gradient of 1/340, I constructed an inverted syphon dropping about 10 ft. below grade. I provided a wash-out at the lowest point of this syphon; whenever I have had an opportunity of inquiring as to the working of this I have found it quite satisfactory. It was many years before my successor found there was a wash-out. At the upper end of this 9-in. sewer I placed an automatic flush tank.

Perhaps it will be argued that with this experience I make excessive provision for access for cleansing; but with this I do not agree. Should an inverted syphon become blocked in work, it would be a most troublesome thing to clear without the most ample provision for access.

Institution of Civil Engineers.—Owing to the possible disorganisation of traffic in present circumstances, the time of the ordinary meetings has been changed temporarily from 8 p.m. to 5.30 p.m.

Crystal Palace School of Practical Engineering.—At the first annual meeting of the Crystal Palace trustees, Alderman Sir David Burnett, the chairman, stated that if they did not get help from the corporation, the London County Council, or the guilds, the trustees would regretfully have to close the School of Practical Engineering. For over forty years the school had been in useful operation, and many of our most eminent engineers had been trained there.

Light Railways in South Yorkshire.—The Board of Trade have confirmed an Order by the Light Railway Commissioners authorising the construction of light railways in the County Borough of Barnsley, in the urban districts of Ardsley, Worsborough, Wombwell, Wath-upon-Dearne, Swinton, Bolton-upon-Dearne, and Thurnscoe, in the parish of Brampton Bierlow, in the rural district of Rotherham, and in the parish of Adwick-upon-Dearne in the rural district of Doncaster. The board has also confirmed the Derwent Valley Light Railway Order authorising an increase of capital for borrowing powers.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not to be hoped that the example set by the Manchester Corporation, in passing a resolution to prevent any contracts being entered into with firms with German or Austrian taint, will be followed by other authorities? Should not everything possible be done to crush these countries commercially as well as their powerful armies? Would not such action, if universal, tend to stimulate home industries with great advantage to this country?

* * * *

Why is it that some councils *will* advertise vacant appointments when there is available a local man who is a "dead cert." for the berth? Was not Salcombe, Devon, an instance of this regrettable action—where a surveyor was required, and advertisements were issued, and applications received, whereas all the time there was a local candidate, eminently suitable for the appointment, who was, of course, eventually appointed? Is such action fair to the other men?

* * * *

Is not Huddersfield to be congratulated on its splendid gift of a new hospital to the military authorities? Should not also our hearty thanks be given to Mr. K. F. Campbell, M.Inst.C.E., the city engineer, for having gratuitously given his services for the design and erection of the buildings, when we all know how arduous are the labours of municipal engineers? Can we not all say, "Well done, Huddersfield, well done, Campbell"?

* * * *

What is the meaning of the following terms that are used in military road construction: "Salient angles," an "Irish bridge," a "French drain," "gabions," a "humped" road, "spitlock" lines, "soling," "berms"? Should these words be included in a glossary of road terms, or are they only peculiar to military requirements?

* * * *

Should not the Surveyors' Institution be very proud of their record of 1,387 members who have joined the Colours since the outbreak of war? Was not the president's recent address on taking the chair another instance of the right sort of president's address during this crisis? Are not most of the professional classes of this country bravely taking their part in this war, and are they not the class which is feeling the stress almost more than any other class?

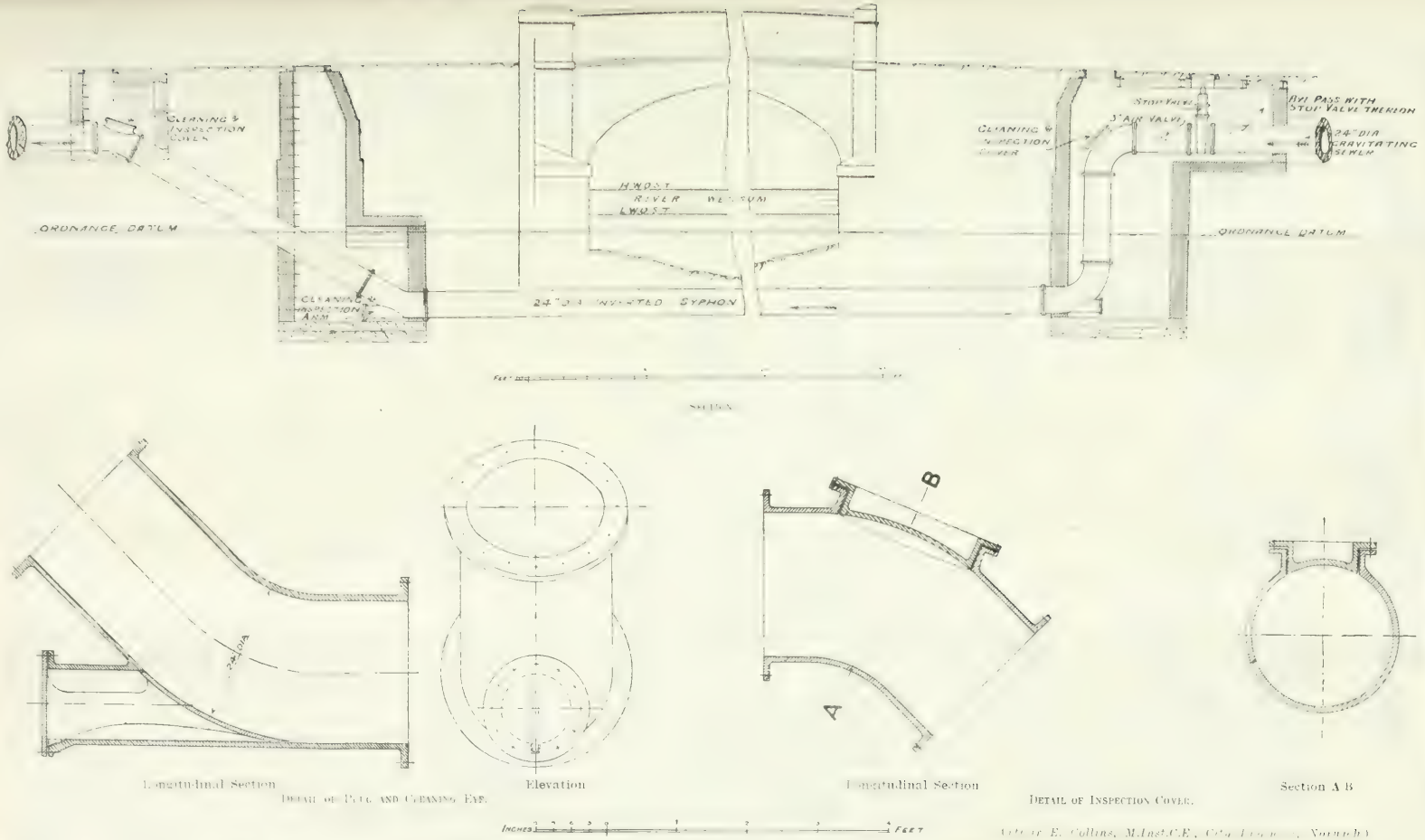
* * * *

Is it not to be hoped that the scheme for the organisation and development of scientific and industrial research emanating from the Board of Education will lead to some practical result? As the "intimate co-operation" with existing scientific or professional societies and institutions is desired, would it not be a good opportunity for the Institution of Municipal and County Engineers to co-operate with the advisory council of the Board of Education in the matter, so that many problems in connection with the scientific side of the surveyor's work might be investigated?

* * * *

How many surveyors have read Mr. Henry A. Blake's letter on "Rubber Pavements and Modern Brain Fag," in the *Standard* of the 18th ult., without being reminded of the well-known adage, "There is nothing like leather," for is not Mr. Blake an acknowledged advocate of rubber, which he so strongly urges should be used on carriageways? When Mr. Blake complains of the noise of traffic as seriously affecting "the nervous system and business power of business men," does he realise that in many of our Northern and Midland cities, where the business men cannot be accused of much lack of nerve or business power, a very large number of streets are still paved with granite or stone setts?

The Late City Surveyor of Bath.—In moving a vote of condolence with the family of Mr. C. R. Fortune, late city surveyor of Bath, at a meeting of the Sanitary Committee lately, Mr. T. Vezey, the chairman, said Mr. Fortune had done his work and served the city well and nobly. He had not spared himself, and had devoted himself with the greatest zeal for the welfare of the city. Mr. Fortune would be greatly missed by the members of the Sanitary Committee, but more especially by the members of the Surveying Committee, with whom his work was more closely identified.



(Col. E. Collins, M.Inst.C.E., City Engineer, Norwich.)

RIVER CROSSING, FYE BRIDGE, NORWICH: GENERAL ARRANGEMENT OF 24 IN. INVERTED SYPHON, DROPPING 11 FT. 6 IN. BELOW GRADE.

Comparative Reports of General Practice.

LXXXIII.—BOWLING GREENS.

Mr. R. A. MacBrair, M.INST.C.E., city engineer and surveyor of Lincoln, has prepared the following tabulation of replies which he has received from various towns in response to inquiries on the subject of bowling greens :—

Name of town.	Estimated population.	Number of greens.	Number of rinks - total.	Do you allow clubs to be formed in connection with the greens?	Do you restrict their matches either with regard to—(a) Number of matches, (b) time of day?	Does each player in a match pay the ordinary fee—what is this?—or an extra one?	General remarks of person in charge of the greens.
Cardiff	195,000	7	42	Yes, one on each green	By giving early notice 4 rinks out of 6 on each green may be reserved for a match	Yes 1d. each per hour	Privileges of clubs very restricted. (See letter)
Darlington ...	63,000	1	28	Yes	Yes	Yes. 2d. each per hour	—
Eastbourne ...	54,000	1	16	Yes	No	Yes. 2d. each per hour	—
Glasgow ...	1,010,831	35	Not given	Yes, but not recognised by committee	Must take their turn with the ordinary public	Yes 2d. each per hour	Experience shows that clubs should not be given privileges, but yet should not be prohibited
Hove ...	44,134	3	13	Yes, but not recognised	No	Yes. 2d. each per hour, season ticket 5s.	—
Liverpool ...	767,992	32	Crown greens	Yes, but not recognised	No	Yes. 1d. each per hour	Tendency for clubs to try and monopolise the greens
Macclesfield ...	35,000	One large green (100 yards by 45 yards)	Not divided into rinks	Only one club allowed	No	Yes. 3d. per game. Season ticket 10s.	Primary object of the public greens should be maintained. Not more than one club match on each green should be allowed
Manchester ...	746,000	37	Capacity for 222	Do not interfere in the matter	Must take their turn with the ordinary public	Yes. 2d. each per 2 hours	Clubs prove very beneficial in encouraging play; tendency to interfere in the management and upkeep
Newcastle-upon-Tyne	273,000	21	147	Yes	No	Yes. 1d. each per hour	Clubs greatly encourage the game, and nothing is placed in their way. Yet they are not allowed to monopolise a green or to interfere in its control
Northampton ...	93,000	7	38	Yes	(a) Clubs have use of half the rinks only (b) No	Each club pays 2s. 6d. for first hour and 1s. 6d. for second hour for 4 rinks	Is of opinion that each player should pay instead of a charge to the club
Salford	240,000	14	Crown greens	Yes, but not recognised	No	Yes. 2d. each per hour	Believes special privileges are unsatisfactory; present system been in operation for 30 years
Scarborough ...	37,000	3 flat and 3 crown	36	Yes, in two cases	(a) Yes; 6 during season. (b) No	No. Use of green granted free for matches	Tendency of a club to monopolise a green to a certain extent, occasionally leading to a little friction; at the same time they attract players
Torquay	40,000	4	16	Yes	No	Yes. Each club member takes a 7s. 6d. season ticket	No monopoly of a green is permitted. One rink at least on a green is reserved for the general public
Wallasey	85,000	13	Rink system not in vogue	Yes	(a) Yes. 9 during season. (b) Yes; Saturday afternoon between 3 p.m. and 6 p.m. except on special occasions	Yes. 1d. each per hour	Season tickets 5s. and 7s. 6d. each. Overshoes compulsory. The game is encouraged and produces the best possible results
West Bromwich	68,014	6	Not divided into rinks	Yes	No	Yes. 1d. each per hour	-

Municipal Economy in War-Time.*

By EDWARD WILLIS, assoc.m.inst.c.e., f.s.i., &c., Engineer and Surveyor to the Chiswick Urban District Council.

(*Conclusion.*)

SEWERAGE.

Dealing first with sewers, I fail to see how any economy can be legitimately effected in this department, if already properly organised, and although I may forego cleaning certain sewers if I am satisfied flooding will not result from the omission, I do not think, as a matter of principle, any economies should be looked for under this heading.

SEWAGE DISPOSAL WORKS.

Here also the margin for economy may vary considerably under different conditions, and one can only indicate in some general way how possible economies can be effected without a material diminution in the quality of the effluent.

Taking the case of material from screens, it is customary to bury or burn this in most districts. There is no doubt its ultimate manurial value is quite good, and efforts should be made to sell some to any farms in the immediate vicinity, thus eliminating the cost of labour in burning.

In the case of sludge, where precipitation treatment is adopted, new markets should be sought for, and if these cannot be obtained, it is often possible to burn portions of this material in the destructor, thus improving the clinker and disposing of a waste material.

On the other hand, another method of temporary disposal is to dress various open spaces with sludge mixed with earth, and where land can be enclosed for hay, surface dressing by sludge will considerably improve the crop.

At the present time most extra-Metropolitan districts who have river or railway freightage can dispose of this bugbear to the sewage engineer without undue cost, as, owing to the very much reduced number of horses, sludge is taking the place of horse manure in farm work.

In regard to precipitants, I would suggest experimenting with reduced quantities, since, when I was second in command of a large precipitation works, large savings were effected in this manner.

The question of utilising all spare land at the farm for saleable crops is another practical economy, but on flooded beds it is one that is open to some objection, since, although I have personally never known of infectious or other diseases being carried by vegetables grown on a sewage farm, there is undoubtedly a sentimental objection thereto.

The question of reducing labour is one that can only be considered when all the details of the works are known, and when one has a most loyal staff of workmen who will willingly do their share of extra work, as we surveyors are all doing during this strenuous war period.

Personally, I hesitate to recommend automatic gear to any large extent as a means for exercising war economies. If appreciable economy could have been obtained by such means, I feel sure there is no engineer in this association who would not have already advised his council in regard to it; but I do think it is possible that in many disposal works small economies can be effected by reducing labour, at possibly the expense of the appearance of the farm, though without detriment to the effluent, the purity of which is our ultimate object.

I remember on one farm with which I was connected comparatively huge sums were spent at times on weeding, and while it vastly improved the appearance of the bacteria and land beds, there was no direct improvement in the effluent, and I therefore only throw this out as a suggestion for economy, which can undoubtedly be effected in some places.

Again, in connection with pumping, coal is mostly used for steam pumps, but at its present excessive price it might be desirable to work in with the coal some coke, and alternatively to mix Welsh and hard steam coal, this latter combination, in my own experience, affording excellent results for heating purposes.

In my present district gas is used as the motive power, and the engineer at the works exercises the utmost care in keeping his engines, as far as possible, up to concert pitch, this being the surest ultimate economy.

REFUSE COLLECTION AND DISPOSAL.

This is a municipal service which must be efficiently maintained to enable the inhabitants to live in reasonable comfort.

I think probably a circular letter, or advertisement by public notices, requesting the residents to burn as much as possible of their organic refuse, will have some appreciable effect on the quantity received.

This was certainly my experience, there being upwards of 1,000 tons less in one year after such notice, and while it does not largely reduce the cost of collection, unless it is paid for on a ton basis, it necessarily decreases the work at the destructor, and in some cases by this means it may be possible to eliminate the night shift where three shifts are worked.

It also has a further advantage, since more ashes are received in proportion to vegetable refuse than would have otherwise been the case.

In some destructors it is customary to use a certain amount of coal to assist combustion.

In these cases I would suggest the adoption of coke breeze, or even smudge, which could probably be purchased at a much cheaper rate than coal; in fact, I have succeeded in getting a barge load of ashes which has sufficient calorific material still available to make this suitable for adding to vegetable refuse to assist destruction.

The question of utilising waste products from the destructor is, of course, always with us, and flag-making is a standard and recognised method of disposal; but I would advocate the provision of some tarred clinker, for there is little doubt this material can be usefully adopted for highway maintenance in roads which are not subject to excessive traffic.

By having rotary screens attached to the crusher, the clinker can be separated to such sizes as to render it fit for concrete as well as for road works and flag paving, and the residue may often be used for gritting or for mixing with mortar as a bedding to flagpaving; thus practically no part of the refuse need be wasted in a district where important works are still in progress.

The question of repairs to plant and machinery should not be treated as an opening for economy, as I am convinced necessary work should be undertaken in spite of the difficult financial conditions occasioned by the war.

WHARVES.

In regard to wharves and jetties, which most local authorities have, where river or canal freightage is possible, I am of opinion that additional income can sometimes be obtained by the engineer approaching large companies or contractors in the neighbourhood, and advising them to utilise such means of transit, and unloading their goods at the council's wharf, since it necessarily follows that increased income must result, if properly managed, with a profit to the council.

DEPOTS.

There is often a somewhat unnecessary expenditure incurred in regard to storekeepers and general assistants in depots and yards.

It is sometimes possible by the exercise of good management to lessen the quantity of unremunerative labour in this department, but I would again emphasise that necessary repairs and upkeep of buildings should not be neglected, this being too often the case.

Savings may also be effected in gas, electric light and water consumption by additional care, or the more rigid enforcement of instructions.

CONVENIENCES.

In regard to underground and overground conveniences, I personally see but little opportunity of material economy being exercised, but slight savings have been effected in this department by cutting down electric light and gas.

BATHS.

In regard to open-air or covered baths, there is often an opportunity of paring down the expenses of these in respect of manual labour and maintenance, since I know of cases where external painting has been carried out annually, and under war conditions can safely be left for two or three years, or even

* Paper read at a meeting of the Lower Thames Valley District Surveyors' Association held at Chiswick Town Hall on the 6th inst.

longer, according to the wearing properties of the paints used.

GENERAL MAINTENANCE OF MUNICIPAL BUILDINGS.

In this connection the same care can be exercised as has been last mentioned.

It is customary in all well-governed municipalities for external upkeep and internal decorations to be maintained in a fairly high state of efficiency, and by reason of such care, if exercised in the past, an appreciable saving can be effected during the next two or three years, since internal decorations can reasonably be deferred for a period of two or three years in most cases, and even external painting can be touched up or varnished, as a preservative to the timber when it is getting bare, thus avoiding the total expenditure of repainting throughout after the usual period of from three to four years.

ROLLING STOCK.

In connection with the upkeep of this material I would advocate a more careful overhauling of each separate vehicle before expending money on repairs and painting. There is no doubt that in some cases it will be wiser and more economical entirely to discard dilapidated carts or vans than thoroughly to repair them, and when it is borne in mind that motor traction will in the future become still more used by municipal authorities, I am satisfied a heavy expenditure on repairs to rolling stock during the present war period may not be advisable as a general rule.

There are, of course, exceptional cases where such may become both desirable and necessary, as also sometimes in the case of steam rollers and motor vehicles; but generally some economies can be effected by the personal experience and instructions of the engineer being used to curb automatic expenditure by subordinate officers or workmen in this department.

OPEN SPACES, RECREATION GROUNDS AND COMMONS.

There should in many districts be ample opportunities of small economies in this department.

I do not personally advocate the taking up of well-turfed lawns to grow cabbages, as has been advocated in the public press, since they will undoubtedly require reinstatement in the future, and a greater expense will be involved at a time when it can be ill afforded; but I am of opinion that economies can be effected in some cases by a reduction of labour, and in a large degree by the elimination of many of the annual replacements made in the portions laid out as flower beds.

It is not suggested that such should be left dull or bare ground, but the transference of flowering shrubs from other parts of the ground can often be made in order temporarily to fill such blanks, with only a slight reduction of any in the amenities of the open space.

PUBLIC HEALTH.

Personally, I fail to see much chance of material economies in this department, as the expenditure must be governed largely by the amount of infectious disease; but I would recommend that all land attached to isolation hospitals should, as far as possible, be utilised for the growing of vegetables, with the prospect of some saving in the future.

FIRE BRIGADE.

Economy in this department as opposed to efficiency would probably be highly disastrous, and it is a moot point if any suggestions even should be made as to a reduction in the expenditure thereon.

Possibly the reconsideration as to the painting of appliances, or decorations to buildings, and the retention of hose for a little longer period than may hitherto have been the current practice, may be legitimate economies, but beyond these I should omit making further suggestions as to a reduced expenditure.

PUBLIC LIBRARIES.

This rate is fixed either at 1d. in the £ by the Public Libraries Act, or up to 2d. by special Private Acts in a few large towns.

For effecting economies in this department I would suggest the following considerations: (1) A possible reduction in the periodicals purchased; (2) a reduction in the purchase of new light literature; (3) possible reduction in lighting; and (4) very careful consideration before proceeding with decorations, which would automatically be due in the war period.

It must, of course, be remembered that considerations of public health must not be forgotten in all places where large numbers of persons regularly congregate, and therefore necessitate efficient cleansing [illegible]

EDUCATION.

As many of our members are professional advisers to Education Committees, it is not unfitting to mention this department.

The point to which we must give most careful consideration during the next three years is undoubtedly as to what actual expenditure is really necessary for the efficient upkeep and maintenance of the school buildings under our care, and the possible extension of periods usually allocated for tar-painting playgrounds, where such extension will not detrimentally affect the permanency of the surface.

In connection with internal school fittings, I would strongly advocate the careful consideration of local authorities before carrying out the somewhat unreasonable requirements of some inspectors of the Board of Education. As an example, some time ago I had quite a considerable number of desks condemned, and yet much worse-shaped desks were at the time being used in Eton College, to my certain knowledge. Surely, what is good enough for boys attending the first college or public school in the country should be sufficient for an elementary school child during the present serious financial condition of this country.

GENERALLY.

In the foregoing few remarks I have tried to indicate in some small measure how possible economies can be effected.

If the engineer and surveyor realises the absolute necessity at the present time of reducing local expenditure, and is allowed to some extent a free hand (with the full support of his council) to exercise true economy, material savings should result.

It is not, of course, possible in a short paper to deal in full detail with the many suggestions made therein, but enough has been said to show that reductions can be effected without seriously prejudicing the rights of future ratepayers.

Some authorities have suggested large decreases in the salaries of the officials, while at the same time they give substantial bonuses to the workmen. There is no doubt that such treatment is hardly fair to the officer, since in most cases he subscribes to local charities as well as war relief funds, and often spends more than his actual salary in the district which he serves, thereby returning to the ratepayers more than he receives from them, as in many cases officers cannot maintain the position their office demands without private means.

Increases in the cost of living affect the officer as well as the workman, and, in addition, the former must pay the heavy increases in income-tax, which will not affect the lower paid workman, who also often pays no rates and has free education and meals for his children.

Happily I notice in the public press that Willesden has set an example of justice by giving a war bonus to the medical officer of health of £250 per annum.

While I do not think such appreciation could be universal, I think justice may often require some consideration being shown to permanent officials, who, where not of military age, have worked long hours in order to avoid filling the places of those on military service, and thus keep down expenses in their respective departments.

I am only throwing out these suggestions for the help of others, as I personally have always received liberal treatment by my council, who have hitherto appeared to appreciate that "the labourer (in whatever department) is worthy of his hire."

There is one economy which I still find is not being exercised by many departments, and yet, although apparently small, if consistently adopted by all throughout the whole war period, the saving would become appreciable.

I refer to that of elaborate stationery, die-stamping on notepaper and envelopes used for local correspondence, excessive printing of minutes and reports, and unnecessary accumulation of statistical information.

This last item is one which may require some consideration before being entirely dropped, and I do not necessarily advocate its entire omission, but cheaper notepaper, lithographed instead of die-stamped, and commoner envelopes, can reasonably be adopted for local correspondence, even if the status of the district is desired to be maintained by elaborate stationery when corresponding with important Government or municipal authorities.

In conclusion, I would strongly advocate councils and local authorities consulting their chief spending officer before advocating the ruthless paring down of estimates and routine work, and thus enable him to

consider the general effect of such possible economy, as there is no doubt the ultimate welfare of the district will be better safeguarded by taking the advice of the engineer and surveyor, who is trained to consider detail and maintenance problems, than that of the laudable councillor, who, while anxious to study the ratepayers, may, if his recommendations are accepted ultimately do more harm than good.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

COUNCIL MEETING.

A meeting of the council of the Institution of Municipal and County Engineers was held at 92 Victoria-street, Westminster S.W., on November 6th, those present being Messrs. H. T. Wakelam (president, in the chair), J. Patten Barber, W. N. Blair, H. Percy Boulnois, H. W. Bowen, John S. Brodie, G. F. Carter, Arthur E. Collins, P. Dodd, Ernest J. Elford, H. Percy Foster, W. Hurpur, T. W. A. Hayward, W. T. Lancashire, L. S. McKenzie Leslie Reservoirs, Norman Scorgie, W. J. Steele, James A. Webb, Charles F. Wike, Edward Willis, Oliver E. Winter, Thomas Cole (consultant secretary), and the secretary.

CLASSIFICATION OF SLAG.

Mr. A. E. Collins reported that at a meeting held that day the Roads and Tramways Committee considered the suggestions for the classification of slag received since the last meeting. In view of the difficulty of the problem it was resolved that the matter be deferred, and that in the meantime the members endeavour to formulate some memoranda on which instructions may be framed which will be useful to surveyors employing the mixture in the construction of roads.

ROAD STATISTICS.

The same committee considered the suggestions for the standardisation of road statistics received since the last meeting, and it was resolved that the members of the institution be asked through the *Journal* to send to the secretary copies of the forms in which they keep their statistics of road upkeep, maintenance, cleansing, watering, tarring, &c., to assist the Roads and Tramways Committee of the institution in preparing suggestions for securing uniformity in practice.

It was resolved that the report be approved and adopted, and it was suggested that the Roads and Standardisation Committees should hold a joint meeting to consider these two questions.

THE MEMBERSHIP ROLL.

Mr. J. Patten Barber reported that at a meeting of the General Purposes Committee it had been resolved to recommend the following gentlemen for—

Election as Members: Messrs. C. A. Howard, surveyor to the Brigg Rural District Council; S. J. James, surveyor to the Sherborne Rural District Council; A. Macarthur, engineer and surveyor to the Cuckfield Rural District Council; A. G. Wheeler, deputy borough engineer, Colchester; and H. A. Bridge, deputy borough surveyor and acting borough surveyor, Chesterfield.

Associate Membership: Messrs. T. L. Parkes, engineering assistant to Walsall Corporation; and A. Proud, inspector of buildings, Stockton-on-Tees.

Studentship: Mr. R. F. Tabor, second assistant borough surveyor, Shrewsbury.

Transfer from Student to Associate Member: Mr. F. B. J. Stephens, deputy surveyor to the Bognor Urban District Council.

Deaths.—The secretary reported the deaths of Mr. J. H. Jevons (Hertford) and Mr. W. H. Leete (Bedfordshire). It was resolved to recommend that letters of condolence be addressed to the relatives.

Examination Applications.—It was resolved to recommend that permission to sit for the institution's examinations be granted to Messrs. O. N. Edwards, W. Greenwood, and J. A. V. Rodrigo.

Articled Pupils on Active Service.—The committee had before them the question of articled pupils on active service, and the difficulty of laying down any hard-and-fast rules with regard to the action to be taken was given lengthy consideration. It was decided to recommend that service with engineering units should be counted as part of the pupilage, and that the cases of pupils serving with other units should be considered as they arose and with as much sympathy as possible.

Size of Committees.—The question of increasing the size of the General Purposes Committee was considered, and it was resolved to recommend that the General Purposes Committee in future consist of eighteen members, and that the Standing Orders be amended accordingly.

The recommendations were approved and adopted by the council.

STANDARDISATION COMMITTEE.

Mr. E. J. Elford reported that at a meeting of this committee the business set out below was transacted.

Classification of Slag.—It was resolved that this committee should co-operate with the Roads and Tramways Committee in the elucidation of this problem.

Standard Forms for Statistics.—It was resolved that a list of subjects in respect of which it is desirable to prepare standard forms for statistics be circulated among the members of the committee for consideration at the next meeting.

Specification for Concrete Flags.—It was resolved to recommend that an endeavour be made to arrange with the British Engineering Standards Committee for the adoption by them of a standard specification for concrete flags, and to suggest that, in the meantime, the committee adopt as a temporary measure the standard specification for concrete flags issued by this institution.

Co-option of Members.—It was resolved that the following members of the council be co-opted on the committee: Messrs. G. F. Carter, W. Jones, and C. F. Wike.

It was resolved that the report be approved and adopted.

REPORT OF ACTING EXAMINERS.

The acting examiners for the examinations held in October, 1915, reported that Messrs. W. Bell, M. S. Brodie, G. H. Connor, J. Daintith, T. B. Draper, N. Hardie, T. H. Longstaff, G. F. Paget, and R. J. Wilkes had passed the testamur examination. It was resolved to award the testamur of the institution to these gentlemen.

The examiners further report that Mr. C. E. Evans had passed the examination for the certificate in town planning, and it was resolved to award him the certificate.

RULES AND SCALE OF FEES FOR SALARIED ENGINEERS.

It was resolved to appoint Messrs. E. J. Elford, T. W. A. Hayward, and C. F. Wike to represent the council to confer with three representatives of the Society of Engineers, to consider the question of drawing up rules and scale of fees for salaried engineers.

ORGANISATION OF RESEARCH.

A letter was received from the Research Council, dated October 4, 1915, inviting the co-operation of the institution in the organisation and development of scientific and industrial research, and it was resolved to refer the matter to the Standardisation Committee with power to take such action as they thought fit.

ENLISTMENT OF MEMBERS.

The question of enlistment of members in H.M. Forces was raised and considered at some length. It was suggested that help perhaps could be given by raising a unit comprised of members of the institution, but in view if previous experience in this matter and the difficulties involved, it was considered that this project would not be practicable. The secretary reported that, although at the beginning of the war an offer was made to the War Office to give assistance in any direction which might be found desirable, no opportunity had been offered to the institution of taking action in this direction. He further reported that he had from time to time given assistance to various members who had been desirous of entering H.M. Forces, and that he had recently received an application from the Royal Engineers unit of the University of London Officers' Training Corps for assistance in obtaining recruits for them. It was resolved that a notice should be inserted in the *Journal* appealing to those members who were able to do so to offer their services to their country in whatever capacity they thought most suitable, and to those members holding chief positions to release as many of their assistants as possible for this purpose. It was further resolved that a notice with regard to the Officers' Training Corps, referred to above, should also be inserted, and that the secretary be instructed to endeavour to obtain facilities for the enrolling of members in other similar units.

Road Surveying cum Road Surveyors' Position.*

By W. J. BROOKE, Surveyor to the Marlborough, Wilts, Rural District Council.

You may consider the first part of this paper egotistical; and I fear you will consider the subject-matter somewhat shoppy, inasmuch as it is our common calling, and I expect we are all fairly fed up with it, considering the ever-increasing traffic and new burdens the highways are now called upon to bear—with the temper of the travelling public, of whom those using inflated tyres and mechanical propulsion form a majority. My views on road work may be old-fashioned, but it is not idle boast to say that I continue the line of management direct from "Macadam" thus—my grandfather spent some fourteen years with Sir James as pupil and as his right hand. He taught my father, and my father initiated me in the mysteries of surveying. The level I use was given by Sir James to my grander pater. At the time of my father's death I tumbled into all his appointments in Wilts and Berks, and for some years I had the supervision of over 1,000 miles of roads, in which were some 200 miles of mains. I have had the good fortune of working with and under seven county surveyors, and it is only reasonable that they imparted information to me of great value.

The grouping of parishes, the creation of councils, and main roads coming under direct county control has completely changed the old régime, but not advantageously to me.

About the year 1830 there were two schools of road management, the "Telford" and the "Macadam." The "Telford" consisted of putting down a hand-placed foundation and upon it a graduated steining. The "Macadam" was superficial treatment only; the latter found most favour, as being the least expensive, and sufficient to cope with the traffic of the day. The traffic was very great on the trunk roads; in fact, forty-eight coaches came through Marlborough a day, and my old grandfather gave £5,000 for the tolls at Leigh Hill Gate House, on the road from Marlborough to Salisbury, for one year's takings.

Much care and attention has now to be given to the roads, but until the passing of several Acts the highways appeared to have been neglected. During the reign of Queen Bess, when trackways, packways, droves, ridgeways, &c., became founderous, all that was done was to cart away the mud; hence, in the old villages you will generally find the roads, as it were, in cuttings. This is to-day a great nuisance, because outlets cannot be cut, and there is the additional difficulty of the length of the side gutters being too long. The system of management under vestries and parish surveyors was a step towards progress, but it had its drawbacks, from the fact that the annual surveyor only repaired the roads he used, and if appointed several years in succession the parish or tything was generally neglected, while the surveyor had a sale for his materials and work for his horses at such times when it-suited his convenience; there was nothing systematic and no continuity of management.

The establishment of Highway Boards was a great step—the grouping of parishes under a paid surveyor—for under this system each parish was charged its own expenditure, and it was accordingly to everyone's interest to keep down expenses and everyone to charge as lightly as possible—here was cohesion. The road surveyor had a responsible and respected position; but now, under the councils, the councils become the surveyors, and the paid agent becomes more subservient.

The tendency to-day is centralisation, and I doubt not that ere many years elapse all main or county roads will be managed imperially, and to this end I think the Road Board has its inception. If this happens it will be hard luck for us, who have devoted our best years to our work, always receiving more kicks than thanks, having no opportunity to save, and nothing to fall back upon.

With the ordinary water-bound surface I do not see how

THE TRIENNIAL SYSTEM,

as advocated by Macadam, can be bettered—by triennial I mean that roads carrying much traffic should have a new surface from end to end every three years, and the thickness of the surface should be sufficient to meet the amount of traffic passing over it.

We will suppose that a road is about to be repaired under an estimate with the county council. The said estimate should allow for one-third of the road's length to be surfaced, but not necessarily contiguous; the lengths which had gone one year should be patched in time when moist, and the lengths which are two years old should be rutted with seconds, and also patched as occasion demands. I am greatly in favour of rutting and rolling, for it tightens and clinches the surface within the road's confines.

In favour of water-bound surfaces much may be said, but all such surfaces must have moisture or a means of retaining it. The Turnpike Trustees had wells every 3 miles or so for the purpose of moistening the roads, but I think a rattling coach and galloping horses must have strained and jarred the roads even more than a motor lorry. The effect of Army transport and artillery proves this. A means of retaining moisture in a surface is a softish matrix to mix with the steining, to make a grout and binder. I am convinced that all water-bound surfaces should have a good convex section; the raising of the gutters and flattening of the crowns, where the latter is only 2 in. or 3 in. above the former, must mean that the limit of saturation is within this 2 in. or 3 in. of the surface, so how can a road stand in wet weather, or how can it dry off in fine?

We are not all so fortunately situated as I am for

ROAD MATERIALS.

My district is on the upper chalk, and nearly all the hills and valleys have denuded deposits of flints. Only recently I have discovered a thick stratum of chalk rock or marl, from which the more recent spelling of Marl-borough may have been derived. The rock is exceedingly tough, it does not flake, and weathers like cement. It has a low degree of porosity—under 2 per cent—is suitable for tar, so much so that I have faith in the results to be obtained with it.

When there is a disease you can often find a remedy near at hand, so I think an equal admixture of marl and flint found side by side will give a thoroughly good surface.

Flint is an exceedingly hard substance, and its coefficient of crushing compares with other materials thus:—

Flints	17·8 to 25·5
Basalt	12·1 to 16·0
Granite	7·7 to 15·8
Limestone	6·5 to 13·5

The composition of flint is a chemical problem, while it baffles geologists to tell us how, in the cretaceous period, it was laid down, and under what conditions. It is indigenous to upper chalk, and a bed of it represents a great thickness of chalk which has been denuded; it may have been in solution, having extraordinary concretionary properties. It is nearly pure silica. I submit a few specimens from my museum, showing sponges, fossils, several curious formations, specimens showing that flints appear to have had contact with metals (how I cannot conceive), also flints decomposing, one showing hardening from a gelatinous state, and several showing how flint, in a liquid state, formed round fossils, filled up holes in sponges, with different forms showing concretion.

Tar-bound surfaces, of course, are the most appreciated, but with them no allowance is made for the

SUBSOIL SPRINGS

to vent, the consequence being that after much rain, with high springs, the surface becomes undulated. If weep-holes are necessary in retaining walls, why not in road surfaces also? The depressions are caused by the springs eroding the subsoil and carrying away particles and soluble matter, causing collapse and subsidence.

The intermittent springs, or bournes, as I know them, have immense inert energy. Last winter some of my roads were blown up by this medium, in one case for a distance of only 2¼ chains. I had to lay a load of wood, two loads of straw, one load of muckle, 350 faggots, 60 yds. of flints, and could not then keep the traffic up, although to open this same piece of road during the previous summer we had to use

* Paper read at a meeting of the Wiltshire Surveyors' Association held at Trowbridge on October 30th.

The Surveyor
And Municipal and County Engineer

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sledges and wedges. These chalk springs seldom break in the same place; they are caused by rains getting into chalk fissures, pipes or suckers, and the head-weight forces them to find their level as if enclosed in a water pipe. I measured one spring, on rising ground, 16 ft. above river level, which rose 9¼ in. above ground; it had a diameter of 7½ in. last January; this had sufficient force, if bridled, to sup- [illegible] some [illegible].

Besides springs we have water vapours, and I have often noticed, after a 2-in. or 3-in. fall of snow, circular bare patches on which the snow could not lay.

I think it is a mistake to prune hedges too closely, excepting at corners and angles, because they aid the retention of moisture in the summer, and a little mud is preferable to dust. There is little fear of accidents now that vehicular lighting is enforced; consequently the need for close-cropped hedges is not so great as it was.

A road surveyor's position is at all times precarious, from the fact that he holds office under the goodwill of his council, subject to a stipulated notice on either side. With this menace hanging over him his powers are often curbed, and he may fear to move conscientiously. He has to take a fearless line, even against members of his own council, if he deems it necessary, and yet he has no

SECURITY OF OFFICE.

I happen to serve under a splendid council and an admirable chairman, so I have this day no axe to grind. A surveyor, as a rule, is frightfully underpaid; he has to keep himself, pay a guarantee, pay for getting about, and many incidental expenses, at a salary generally under £150 per annum—an inadequate one. For this sum he has usually to give his whole time, and be sanitary inspector also. He has more spending powers than any official, and yet if a set is against him he can be discharged without even a testimonial. A surveyor should be able to appeal to a tribunal for compensation, because he is seldom in a position to fight a council, and the ratepayers' pockets, and meet counsel with counsel at law.

A surveyor should be able to keep at least an office boy, so as to release him from some of his office work. He should be allowed a reasonable sum for travelling expenses, especially he who has a rural district. He should be eligible for a pension, after so many years of satisfactory service, because, as matters now stand, unless a surveyor uses his first appointment as a stepping-stone, with his small salary he can have saved little to tide over old age. I think, too, a surveyor should be allowed fees for new buildings, breaches of by-laws, water testing, drain testing, and some of his overtime. His salary should be arranged by an impartial committee of surveyors or experts, who could consider the circumstances of his case, as to mileage, capability, area of district, number of men under his supervision, and his qualifications. In other words, a surveyor should be paid better than a mechanic or tramcar driver.

CORRESPONDENCE.

Ἐς ἄνηρ οὐ πάντ' ὀρᾷ
(One man does not see everything.)
—EURIPIDES.

HEDGE TRIMMING AND TREE PRUNING.

To the Editor of THE SURVEYOR.

SIR,—Now is the time for hedge trimming and tree pruning. Owners of and residents in property having road frontage, especially at corners and junctions, are particularly asked, in the interests of public safety, to have all overhanging or view-obstructing hedges and branches cut down.

This work is exceptionally urgent and important this year consequent upon military traffic at night, the general reduction in lighting throughout the country, and the fact that many proposed road improvements, which would in most cases have obliterated all danger, have been postponed.

The Roads Improvement Association has found property owners very reasonable in meeting the needs of the public in this matter, although, curiously enough, they themselves are frequently unaware of any danger until their attention is directed to it.

Road users, therefore, who are acquainted with any places made dangerous by overgrowing trees, shrubs, &c., are invited to send full details to the undersigned. All reports will be carefully investigated and such action as may appear desirable will be taken to remove any danger.—Yours, &c.,

WALLACE E. RICHE,
Secretary, Roads Improvement Association.

15 Dartmouth-street, S.W.
November 12, 1915.

THE SUPERINTENDENCE OF HOUSE CONNECTIONS.

To the Editor of THE SURVEYOR.

SIR,—In reply to the query of "T.," which appears in your issue of the 12th inst., the superintending of the laying of house drains and their connections with the sewers has always been done by me, as surveyor, or by the foreman acting under me, and not by the sanitary inspector. I have never known, during forty years' experience as a municipal surveyor or assistant in a surveyor's office, this duty to be undertaken by the inspector of nuisances, excepting, of course, where that officer also acts as surveyor.

Your correspondent, however, does not say whether the erection of new buildings within his district is under his supervision, or, as I believe is sometimes the case, under that of the sanitary inspector; if the latter, then I imagine the duty of superintending the laying of the drains would, as a matter of course, devolve upon him; but the surveyor should, nevertheless, insist upon seeing that the connections of the drains with the sewers are made to his satisfaction.—Yours, &c.,

ROBT. S. SCOTT.

Surveyor's Office,
Bishop's Stortford.
November 17, 1915.

The Manchester Parks.—The Manchester Parks Committee have published a handbook to the parks and open spaces of the city. Manchester has now seventy parks and recreation grounds with a total area of 1,480 acres. Manchester was the first city to provide itself with municipal parks (Queen's Park and Philips Park.

The Coventry Housing Scheme.—The Coventry Corporation last week accepted a tender of Messrs. Alban Richards & Co., Cardiff, for the erection of 600 houses on the Grange Farm estate, Wyken. The details of the tender are as follows: Houses, £165,816; roads and sewers, £20,000; scheme for treatment of sewage (estimate), £3,000; provision of temporary housing accommodation for men engaged on the work, £2,400; total, £191,216. Cost of land (50 acres at £200 per acre), £10,000; total, £201,216. The Ministry of Munitions has agreed to pay the difference between the pre-war cost of the houses and present cost, and 20 per cent has been agreed upon as the figure.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

Mr. J. G. Wilkes, of Downpatrick selected in respect of his moiety of the October premium

"Practical Building Construction," by J. P. Allen (Lockwood), and

"Elementary Reinforced Concrete," by Ewart J. Andrews (Scott, Greenwood & Son).

Mr. J. A. Riccomini, of Chatham, to whom the other moiety was awarded, chose—

"Waterworks Engineering," by F. C. Finch (St. Bride's Press, Limited), and

"Structural Economy," by E. A. Slater (St. Bride's Press, Limited).

These books have been duly forwarded.

QUESTIONS.

This week answers are invited to the following questions:—

511. Tramway Construction.—Discuss spiralisation in tramway construction. (J. D., *West Hartlepool.*)

512. Hydraulic Gradient. A horizontal main consists of 1,000 ft. of 6-in., 5,000 ft. of 9-in., and 5,000 ft. of 12-in. diameter. The velocity in the 6-in. is 12 ft. per second, and the pressure head 50 ft. at the inlet. Sketch the hydraulic gradient (*a*) supposing that only the skin friction is considered; (*b*) supposing that both skin friction and the losses of head due to abrupt changes of section are considered. Write down the expressions for the several losses of head. ("Enquirer.")

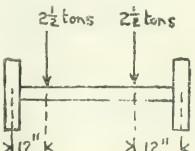
514. Water Supply.—A storage reservoir and a service reservoir are situated at a distance of 5 miles apart, and are connected by a 12-in. main, which, at a point 1 mile from the service reservoir, feeds a 10-in. distributing main. The top-water levels of the storage and service reservoirs are 850 and 750 ft. respectively above ordnance datum, and the level at which the distributing main leaves the trunk main is 400 ft. above ordnance datum. When water is passing into the distributing main at the rate of 60,000 gallons per hour, what will be the (1) pressure in the trunk main at the connection with the distributing main? (2) the quantity of water passing from each reservoir towards that point? and (3) the hydraulic gradients from the reservoirs to the junction of the trunk and distributing mains? ("Ionic.")

515. Sewage Effluent.—Litmur paper is sometimes used in trying the quality of a sewage effluent. State how this is done, and also how to determine roughly the quality and purity of a sewage effluent by this means. ("Student.")

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

510. Axle Stress.—An axle fixed to two wheels is driven at the centre by a chain, and supports two bearings, distant 12 in. from the centre of the wheels, the load on each bearing being 2½ tons. If the power exerted is 20 h.p., and the rate of turning is 30 revs. per minute, find the maximum intensity of stress in the axle if its diameter is 5 in. (Student.)

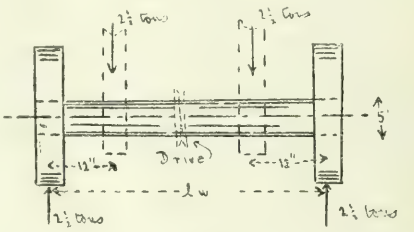


The precise arrangement of the wheels on the axle relative to the bearings is not absolutely clear from the question, but it is assumed that the placing as in sketch is intended.

Let the distance from centre to centre of the wheels = l inches. Reaction at base of each wheel = 2½ tons.

∴ Bending moment at centre of axle, due to axle loads only = $2\frac{1}{2} \times \frac{1}{2}l - 2\frac{1}{2}(\frac{1}{2} \times 12) = 30$ in.-tons.

It will be observed from this result that the bending moment due to the axle loads is independent of l, but an examination of the bending moment diagram for this particular fact will show it to be quite feasible.



To find the twisting moment due to the torsion on the shaft, we have—

If N = number of revolutions per minute made by shaft,
H P = the horse-power transmitted by shaft.
M_t = the twisting moment due to the h.p. transmitted in inch-lb.
P = the driving force at rim of shaft (in lb.)
R = the radius of the shaft in inches.

Then $M_t = P R$ Also $H P = \frac{2\pi R N P}{12 \times 33000} = \frac{2\pi N M_t}{12 \times 33000}$

$$\therefore M_t = \frac{63025 \text{ H P}}{N} \text{ inch-lb.}$$

$$= \frac{63025 \times 20}{2240 \times 30} \text{ inch-tons} = 18{\cdot}76 \text{ inch-tons.}$$

Now if bending moment due to axle load = M, and twisting moment = M_t, it can be proved that equivalent twisting moment = $M + \sqrt{M^2 + M_t^2}$

∴ In this case equivalent twisting moment

$$= 30 + \sqrt{30^2 + 18{\cdot}76^2} = 65{\cdot}38 \text{ inch-tons.}$$

But twisting moment = moment of twisting resistance,

$$i.e., \quad 65{\cdot}38 = \frac{\pi}{16} f_s d^3, \text{ where}$$

d = diameter of shaft in inches,

and f_s = extreme fibre stress in tons per sq. inch.

$$\therefore f_s = \frac{16 \times 65{\cdot}38}{\pi \times 125} = 2{\cdot}664 \text{ tons per sq. inch.}$$

(B. K., *Newport.*)

This is a case in which a shaft is subjected to both twisting and bending moments. The part of the axle outside of the bearing acts as a cantilever with an end load of 2½ tons and a length of 12 in., and therefore the B M = W L = $^3/_2 \times 2240 \times 12 = 67200$ inch-lb. The twisting moment in the axle is the amount of work done divided by the angular displacement of the shaft in the same time; therefore

$$\text{T M} = \frac{\text{W D}}{2\pi} = \frac{20 \times 33000 \times 12}{2 \times 3{\cdot}1416 \times 30} = 42016 \text{ in.-lb.}$$

where n = number of revolutions of shaft per minute.

For a solid shaft the torsional resistance of the section is—

$$\text{T R} = \frac{\pi}{16} \text{D}^3 f_s \text{ but T R} = \text{T M.}$$

$$\therefore f_s = \frac{\text{T M}}{\frac{\pi}{16} \text{D}^3} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Where D = diameter of shaft in inches f_s = maximum shear stress in lb. per sq. inch.

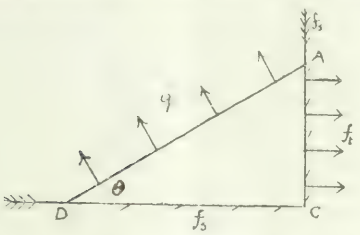
Again, for a similar section, the moment of resistance to bending is—

$$\text{M R} = \frac{\pi}{32} \text{D}^3 f_t, \text{ but B M} = \text{M R.}$$

$$\therefore f_t = \frac{\text{B M}}{\frac{\pi}{32} \text{D}^3} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where f_t = maximum tensile or compressive stress in lb. per sq. inch.

We have now to combine these stresses (f_t and f_s) so as to obtain what is known as an equivalent tensile or shearing stress. It is well known that a shearing stress on any plane produces a shearing stress of equal intensity on planes at right angles to it. Suppose that across a plane A C, at right angles to the paper (see fig.), we have a normal stress tensile or compressive of f_t lb. per square



inch, and a shearing force of f_s. We shall then have on A C a normal force of f_t (assuming that A C is 1 sq. inch in area) and a shearing force of f_s; on D C a shearing force of $f_s \times$ area of D C $= f_s \times$ D C $= f_s \cot \theta$, as A C is 1; on A D a force $q \times$ area of A D $= q$ A D or $q \operatorname{cosec} \theta$. It is this force and its direction that we have to calculate.

Resolving the forces horizontally $f_s \cot \theta + q = q \operatorname{cosec}^2 \theta \times \sin \theta$ or $f_s \cot \theta + q = q \operatorname{cosec} \theta \cos \theta$ or $f_s = q \cot \theta$ . . . . . (2)

$\therefore \cot \theta = \frac{f_s}{q}$ . . . . . (3)

Substituting this in (3) we get—

$\frac{f_t}{q} + \frac{f_s}{q} \times \frac{f_s}{q} = 1$ or $q^2 - q f_t - f_s^2 = 0$

$\therefore q = \frac{1}{2} f_t \pm \sqrt{\frac{1}{4} f_t^2 + f_s^2}$

We take the positive sign of this quadratic so that

$q = \frac{1}{2} f_t + \sqrt{\frac{1}{4} f_t^2 + f_s^2}$ . . . . . (5)

Substituting formulæ (1) and (2) in (5) we get

$$f = \frac{16}{\pi D^3} B M + \sqrt{B M^2 + T M^2}$$

Inserting values we get

$$\frac{16}{3{\cdot}1416 \times (5)^3} 767{,}200 + \sqrt{(767200)^2 + (42910)^2}$$

$= 5950$ lb. per sq. inch.

C. A. K. *Chatham.*

513. Hydraulics.—Calculate the percentage loss of horse-power per 1,000 yds. in hydraulic transmission through clean lead pipes, 4½ in. diameter, with water velocities 2, 3 and 4 ft. per second, and with pressures 200 lb., 700 lb., and 1,200 lb. per square inch [illegible] all [illegible] losses and represent your calculated results by curves. ("Enquirer.")

Case (1)—

$p = 200$ lb. per sq. in.

$\therefore$ pressure head at inlet $= 200 \times 2{\cdot}3 = 460$ ft. The discharge and the cross-sectional area of the pipe are constant throughout. Therefore, using D'Arcy's formula, which states that

$$h = \frac{2 f l v^2}{g d}$$

where h = head in feet lost in friction
f = coefficient of friction
l = length of pipe in feet
v = velocity of water in feet per second
d = diameter of pipe in feet

and taking f as ·0073, say, we have

$$h = \frac{2 \times {\cdot}0073 \times 3600 \times 4}{32 \times {\cdot}375} = 14{\cdot}6 \text{ ft.}$$

$\therefore$ pressure head at outlet $= 460 - 14{\cdot}6 = 445{\cdot}4$ ft.

Pressure energy at inlet end of pipe

$= {\cdot}7854 \times (\cdot375)^2 \times 2 \times 60 \times 62\frac{1}{2} \times 460 = 381{,}000$ ft.-lb. per minute (*i.e.*, lb. of water passed per min. × equivalent height fallen through).

$\therefore$ available h.p. at inlet end of pipe

$$= \frac{381000}{33000} = 11{\cdot}56 \text{ h.p.}$$

pressure energy at outlet end of pipe

$= {\cdot}7854 \times (\cdot375) \times 2 \times 60 \times 62\frac{1}{2} \times 445{\cdot}4$

$= 369000$ ft.-lb. per min.

$\therefore$ available h.p. at outlet end of pipe

$$\frac{369000}{33000} = 11{\cdot}18 \text{ h.p.}$$

$\therefore$ loss of h.p. per 1000 yds. due to skin friction

$= 11{\cdot}56 - 11{\cdot}18 = {\cdot}38$ h.p.

$\therefore$ percentage loss per 1000 yds. $= \frac{38}{11{\cdot}56} = 3{\cdot}29$ per cent.

Considering a point midway between inlet and outlet ends of pipe, we have:—

Head lost in friction to this point

$$= \frac{2 \times {\cdot}0073 \times 1500 \times 4}{32 \times {\cdot}375} = 7{\cdot}3 \text{ ft.}$$

$\therefore$ pressure head at this point

$= 460 - 7{\cdot}3 = 452{\cdot}7$ ft.

$\therefore$ available h.p. at this point

$$= \frac{{\cdot}7854 \times (\cdot375)^2 \times 2 \times 60 \times 62\frac{1}{2} \times 452{\cdot}7}{33000}$$

$= 11{\cdot}37$ h.p.

This is the mean of the two results obtained above; consequently the curve showing the loss of h.p. per unit length of pipe will be a straight line, which is what would be expected from the form of the above working. We proceed in the same way for the other cases.

Case (2)—

$p = 700$ lb. per sq. in.

$\therefore$ pressure head at inlet $= 700 \times 2{\cdot}3 = 1610$ ft

As before,

$$\text{head lost in friction} = \frac{2 \times {\cdot}0073 \times 3000 \times 9}{32 \times {\cdot}375} = 32{\cdot}85 \text{ ft.}$$

$\therefore$ pressure head at outlet $= 1610 - 32{\cdot}85 = 1577{\cdot}15$ ft.

$\therefore$ available h.p. at inlet end of pipe

$$= \frac{{\cdot}7854 \times (\cdot375)^2 \times 3 \times 60 \times 62\frac{1}{2} \times 1610}{33000}$$

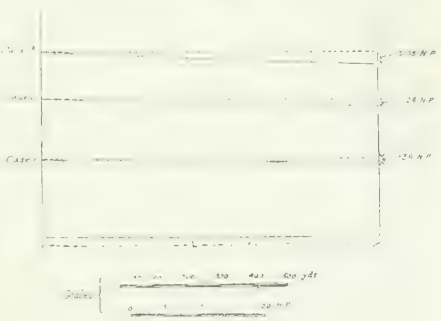
$= 60{\cdot}62$ h.p.

$\therefore$ available h.p. at outlet end of pipe

$$= \frac{{\cdot}7854 \times (\cdot375)^2 \times 3 \times 60 \times 62\frac{1}{2} \times 1577{\cdot}15}{33000}$$

$= 59{\cdot}38$ h.p.

$\therefore$ h.p. lost per 1000 yds. $60{\cdot}62 - 59{\cdot}38 = 1{\cdot}24$ h.p.

$\therefore$ percentage loss $\frac{124}{60{\cdot}62} = 2{\cdot}045$ h.p. per cent.

Case (3)—

$p = 1200$ lb. per sq. in.

$\therefore$ pressure head at inlet $= 1200 \times 2{\cdot}3 = 2760$ ft.

$\therefore$ head lost in friction $\frac{2 \times {\cdot}0073 \times 3000 \times 16}{32 \times {\cdot}375} = 58{\cdot}4$ ft.

$\therefore$ pressure head at outlet $= 2760 - 58{\cdot}4 = 2701{\cdot}6$ ft.

$\therefore$ available h.p. at inlet end

$$= \frac{{\cdot}7854 \times (\cdot375)^2 \times 4 \times 60 \times 62\frac{1}{2} \times 2760}{33000} = 138{\cdot}6 \text{ h.p.}$$

$\therefore$ available h.p. at outlet end

$$\frac{{\cdot}7854 \times (\cdot375)^2 \times 4 \times 60 \times 62\frac{1}{2} \times 2701{\cdot}6}{33000} = 135{\cdot}55 \text{ h.p.}$$

$\therefore$ h.p. lost per 1000 yds. $= 138{\cdot}6 - 135{\cdot}55 = 3{\cdot}05$ h.p.

$\therefore$ percentage loss $= \frac{305}{138{\cdot}6} = 2{\cdot}2$ per cent.

Note re Scale of Diagram.—A deduction of 50 h.p. has been made in the h.p. scale of case (2), and 110 h.p. in case (3), on account of space. The dotted lines indicate the uniform h.p.—*i.e.*, what it would be if there were no losses.

Damp Walls. In the construction of new houses much consideration is directed by the authorities towards the vital question of the health of the future inmates. Many old houses are condemned because the walls are saturated with water. We learn that a house wall situated next to a river at Bingley (Yorks) has been made absolutely watertight with a Pudlood cement rendering.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Aylesbury U.D.C.—The surveyor, Mr. W. H. Taylor, has been instructed to obtain tenders for each of two alternative schemes for an isolation hospital.

Bournemouth T.C.—The town clerk, Mr. F. W. Lacey, has been instructed to obtain information from other places with respect to the erection of curative baths, so as to secure a share of the patronage given to German spas.

Budleigh Salterton U.D.C.—A report has been submitted on a conference held at Exeter with respect to the provision of a joint smallpox hospital, and it was stated that the capital liability involved upon the urban council would be about £50.

Dorset C.C.—The Works Committee report that the repairs to the groynes at Preston Beach had been carried out by direct labour at a cost of £63.

Durham C.C.—The Health Committee recommend the extension of the kitchen accommodation at Holywood Hall sanatorium, at an estimated cost of £350, and also an electric light installation at an estimated cost of £820.

Frinton U.D.C.—The surveyor, Mr. E. M. Bate, reported that there had been a slight extension of the outward bulge in the sea wall near the Shelter, and it was agreed that immediate steps should be taken for the strengthening of the wall, at an estimated cost for material of £80 and the labour about £40. The surveyor was also directed to have the seaward ends of several of the timber groynes repaired.

Hebburn U.D.C.—It has been agreed to provide two additional public conveniences.

Holme Cultram U.D.C.—It is reported that a small encampment and testing station is to be erected at Silloth by the Munitions Department. The scheme will involve the provision of a water supply from the Bitterlees main to the encampment and the construction of a new road.

Littlehampton U.D.C.—It is reported that Army medical officers have inspected several sites for a temporary hospital to accommodate between 4,000 and 5,000 patients.

Monmouthshire C.C.—The final accounts have been passed in connection with the extension of the county council buildings. The cost of the extension, which includes buildings, heating and ventilating, electric lighting, and furnishing, is £24,753.

Seaham Harbour U.D.C.—It has been resolved to invite tenders for an iron portable convenience.

Warminster U.D.C.—Arrangements have been made for the erection of a number of public conveniences, part of the cost of which would, it was understood, be met by the War Office.

HOUSING AND TOWN PLANNING.

Flegg (East and West) R.D.C.—Arrangements have been made to complete the purchase of land at Hemsby for a housing scheme.

PARKS AND OPEN SPACES.

Dublin T.C.—The Cleansing Committee of the corporation recently advertised for competitive designs for the laying out of the reclaimed slobland at Fairview, and the conversion of the same into a public park. With the approval of the municipal council, prizes were offered of £50, £10, and £5 respectively for the first, second, and third designs selected. The total area of the reclaimed ground will, when the scheme is completed, amount to 55 acres, from which, however, an area of about 2 acres will be allotted for a lake, and about 9 acres for an athletic ground. Subject to these arrangements, and the condition also fixed by the council, that the plans should provide for a wide avenue (for pedestrian traffic only) through the park from Annesley Bridge to the Howth-road, the entire arrangement of the laying out of the ground was left an open question. Nine competitors sent in designs, and in some cases individual competitors sent in more than one design. Sir Frederick Moore, curator of the Botanic Gardens, and the city architect, Mr. C. J. MacCarthy, who acted as judges, made their award as follows: First prize—Messrs. William Power & Co., landscape gardeners, King-street, Waterford; second prize—Mr. Horace T. O'Rourke, "Lytlehome," Cabra-road, Dublin; third prize—Miss Henrietta C. Tuke, 8 Upper Fitzwilliam-street, Dublin.

Glasgow T.C.—Balloch estate, purchased by the corporation for £30,000 for the purposes of a park and recreation ground, is now the property of the city.

Grimsby T.C.—At the recent sale of the Bradley estate the corporation purchased, through an agent, about 98½ acres of arable land for £2,895, and about 62½ acres of woodland, known as Bradley Wood, for £1,725. The woods are to be used for recreative purposes, and the land for burial purposes. The borough surveyor, Mr. H. Gilbert Whyatt, said that the Local Government Board had allowed a loan on sixty years, repayment for all but 6½ acres of the land. For that plot the term was five years. Already part of the land had been let, and was bringing in £177 10s. per year. For five years there looked like being a loss of £20 per annum upon the purchase, but after that period there would be a profit on the arable land of £66 per annum, until such time as it was required for burial purposes. Setting this profit against the cost of maintaining the woods as a public resort, the corporation had become the owners of something over 160 acres of land at a cost of about £10 per year.

Sowerby Bridge U.D.C.—The surveyor, Mr. J. Eastwood, has been instructed to erect railings on the bottom side of the top slope of the recreation ground, leaving an entrance at each end and one in the middle, and also form a footpath inside the railings, at a cost of £80.

REFUSE COLLECTION AND DISPOSAL.

Bath R.D.C.—An agreement has been signed with the Bath Corporation for the latter to take and burn the house refuse of Weston, at a charge of 2s. 9d. per ton.

Richmond (Surrey) T.C.—Subject to approval of the details of the scheme of Mr. W. Fairley, the engineer to the Richmond Main Sewerage Board, for burning the town's refuse at the board's works, the council have approved of the principle of disposing of the refuse by incineration. The decision is the outcome of the board's reference of the matter to the constituent authorities (the Richmond Town Council and the Barnes Urban District Council) for their observations. The scheme provides for the erection at the board's works of furnaces and other plant capable of dealing with 7,500 tons of refuse per year. The estimated cost is £12,500, and with coal at its present price the scheme shows a considerable profit to the two districts, as the board's coal bill will be considerably reduced owing to the use of the refuse for raising steam at the works.

ROADS AND MATERIALS.

Bognor U.D.C.—Conditional upon terms for the payment of the money over a period of three years being accepted, it has been agreed to purchase Derby House, at the junction of Lyon-street and High-street, for a widening scheme. The price of the property is £410.

Cambs C.C.—With reference to the application of the Cambridge Town Council for the maining of certain roads the county council decided recently that no applications for maining be entertained at present.

Cumberland C.C. — The county surveyor, Mr. William Finch, submitted a letter from the director of works with regard to the roads in the Longtown district, and the clerk having reported as to the result of the conference the county surveyor had had with the director, the Highways Committee had resolved that the county surveyor should take steps to maintain these roads in proper condition, and that detailed accounts of all expenditure on them be made in order that such claims as may arise can be made upon the authority responsible for the extra traffic which now prevails in the district.

Diss U.D.C.—The surveyor, Mr. A. Cooper, reported that the Road Board were still in correspondence respecting the repairing of Walcot-road; that the board

[illegible] a representative who had examined the road and modified the estimate; that he had been to N[illegible] and had an interview with the contractor, who had agreed to the suggested alterations. The work will be commenced as soon as the formal authorisation of the Road Board is received. The clerk, Mr. H. O. Lyus, reported that he had written to the county council claiming the full cost of tarring the main roads in the district, and in reply had received a letter from the clerk to the effect that if he would obtain particulars of the Gainsborough arbitration he would see that the Diss authority had no claim for the full cost of tarring main roads in the urban dis[illegible] the Road Improvement Committee to reply to the letter to his effect. The writer added that the committee would recommend the county [illegible] certain small portions to which they were committed by arrangements with the Road Board. No contributions for tarring would be made to the urban authorities. The clerk was instructed to obtain further information.

Dudley T.C.—The borough surveyor, Mr. J. Gamage, has been instructed to prepare plans and invite tenders for widening and sewering Bunn's-lane, [illegible].

Monmouthshire C.C.—The county surveyor, Mr. W. Tanner, has received instructions to carry out the necessary work in connection with the dangerous turning on the main road at St. Mellons at an estimated cost of £25. The county surveyor presented a report containing suggestions for further reducing the expenditure upon the main roads which has been referred to the Economy Committee. Arising out of the report it has been decided that the services of three of the county surveyor's assistants—namely, Mr. A. G. Babbage, district surveyor, Mr. W. G. Lewis, draughtsman, and Mr. N. Birkett, clerk—be dispensed with.

Staffs C.C.—The Main Roads and Bridges Committee report that, notwithstanding the application during the present financial year of a much larger quantity of metal on the Walsall and Birmingham road than during any previous year, there are still lengths in a very unsatisfactory condition, and they have authorised the county surveyor, Mr. J. Moncur, to carry out the necessary work at an additional cost of £800. Application will be made to the Road Board for a grant towards the extra cost of tarred work on the road.

Stoke-on-Trent T.C.—The town council have resolved to apply to the Road Board for a grant towards the extra cost of Tarvia on the Walsall and Birmingham main road.

Swindon T.C.—A letter was laid before the council from the officer commanding the Pioneer depot at Weymouth, pointing out that as a number of men were requiring training at road making, &c., he could place some men at the disposal of the council for road making. Alderman Brooks understood there would be about 1,000 men in Swindon and neighbourhood, and that 200 of them could be at the service of the council for road making or excavations. It was thought that the soldiers in question might be useful in carrying out the proposed widening of Wroughton-road, which had been in contemplation for some time, the council having intended the work to be completed in sections, on the score of expense. The estimated cost of the work was £5,000. Alderman Walters hoped that the employment of soldiers would not mean the discharge of any men in the service of the council, while Alderman Plaister uttered a warning that the council should be chary of agreeing to that which might commit the town to a capital expenditure. The town clerk remarked that it was a matter of some urgency, and he was in communication with the county council. After some further discussion, the letter containing the [illegible] was referred to a sub-committee.

SEWERAGE AND SEWAGE DISPOSAL.

Kiveton Park R.D.C.—The Local Government Board have conferred upon the council powers under the Private Streets Works Act in respect of the sewering of several streets.

Uckfield R.D.C.—The clerk, Mr. F. Holman, stated that [illegible] had written to the Local Government Board pointing out the difficulties in which they had placed the council with regard to the Mayfield drainage question. He had also explained the extra expense which had been incurred owing to the fact that the board first gave their consent to the raising of a loan and then withdrew it, and that in the meantime the council entered into a contract. He therefore asked the board to reconsider their decision. After writing the letter he had an opportunity of getting the money from the local Friendly Society, and he wrote again to the Local Government Board asking if they had any objection to the council borrowing it. He had, however, not yet received a reply to either letter.

Wells T.C.—The Sewage Disposal Committee reported that they had inspected the whole of the sewage works, and were pleased to state that they were very satisfied with their condition. The committee had received three tenders for mangolds, and had accepted that of Mr. Hales at 12s. a ton. The city surveyor, Mr. C. Pursey, explained to the committee various recommendations having for their object the saving of expense, and at the same time making the works more efficient, and the committee, being confident that the works would be very much improved permanently, had instructed the surveyor to carry out the work from time to time as convenient. The mayor, in moving the adoption of the report, said the members were very pleased with the condition of the farm, and he believed they would have an ideal sewage farm. It was very satisfactory. The motion was carried.

Wombwell U.D.C.—The surveyor, Mr. W. Quest, has received instructions to prepare plans for the extension of the sewage disposal works at New Scarborough.

WATER, GAS, AND ELECTRICITY.

Cardigan R.D.C.—Consideration is being given to a proposal for a water supply for Gwerinedd, which is estimated to cost £400.

Chelmsford T.C.—The town council have resolved to notify the local gas company of their intention to purchase their undertaking.

Coseley U.D.C.—The surveyor, Mr. C. E. Horton, has been instructed to prepare a storm-water scheme for Deepfields.

Coventry T.C.—It is proposed to effect further extensions of the electricity undertaking, at an estimated cost of £30,275.

Doncaster T.C.—A letter has been received from the Treasury stating that they would raise no objection to the borrowing of £286 in respect of capital already expended on mains, but that they were unable to sanction any further borrowing for the purposes of the gas undertaking. The council have decided that further expenditure on new plant, mains, and meters, be paid for out of revenue.

Lancaster T.C.—Tenders of £9,695 for rebuilding a section of the retorts at the gasworks and of £7,895 for installing water-gas plant have been accepted.

Montrose T.C.—It is proposed to lay a 9-in. supply pipe from the reservoir to the well at the asylum for fire-extinguishing purposes.

Neath R.D.C.—The surveyor of highways, Mr. D. M. Davies, reporting on the storage reservoir of the Ystradfellte water undertaking, said a twenty-eight days' test showed that the works had proved excellent and most reliable, and that there was a combined daily supply of 4,152,000 gallons. The water supply had been fully equal to the abnormal demands during a period of severe drought, which had caused grave anxiety to many other public bodies. The council considered this very satisfactory.

Nuneaton T.C.—In connection with the Griff water supply it has been agreed to instal a water-softening plant, at a cost of about £700.

Ripley, Derbyshire, U.D.C.—At a special meeting last week, a deputation appointed to interview the Ilkeston and Heanor Water Board with respect to furnishing Ripley with a fluctuating supply of water reported the result of their interview. At the same time the Special Water Committee, which had been investigating questions concerning the town's needs, reported that it appeared there were indications of leakage in the council's reservoir, and it was desirable that this should be repaired forthwith before proceeding further to acquire additional water. It was further pointed out that the question of increasing the storage capacity of the well and lodge at the works was being considered, and as this might have a bearing on the additional quantity to be taken it was resolved to adjourn the whole question pending the completion of the investigations, which it is hoped will be completed before Christmas.

Sheffield T.C.—Electricity mains extensions are to be carried out at an estimated cost of £550.

West Bromwich T.C.—The Electricity Committee recommend the town council to make additions to the electricity generating plant, at an estimated cost of £8,850.

MISCELLANEOUS.

Birmingham T.C.—The Estates Committee have purchased 11 acres of land for the extension of the Brandwood End cemetery, at £150 per acre.

Chatham T.C.—It has been decided to establish a municipal coal depot.

Doncaster R.D.C.—The question of the maintenance of the banks of the river Trent was discussed, the clerk reporting on a conference that had been held by representatives of the Lindsey (Lincolnshire) and Notts County Councils, the rural councils of Doncaster, Goole, Thorne, and the Hatfield Chase Corporation and the Adlingfleet Commissioners at Doncaster. The deputation recommended that they should suggest to the Board of Agriculture that one authority should have jurisdiction over the whole of the west bank of the Trent. It was proposed that this be embodied in a resolution, and the chairman, in seconding, said there were thousands of acres of land water-logged in that district.

Hampton U.D.C.—In reply to a letter from the Urban District Councils' Association, who have been asked by the Home Office to prepare a reasoned statement from district councils as to experienced officials whose services must be retained, the council have intimated that they wish to retain the services of the surveyor (Mr. S. H. Chambers), assistant clerk (Mr. Walter Singleton), and foreman (Mr. Jackson). Mr. Chambers has informed his council that he had been canvassed, and has replied that he was prepared to serve his country, but that, of course, he had responsibilities to the council. Mr. Singleton had not been canvassed, but he held the same view as the surveyor's.

Surbiton U.D.C.—The tender of Messrs. Neale & Co., of Wandsworth, at £70, has been accepted for laying out the new cemetery.

Swinton U.D.C.—The Local Government Board have written that they would not refuse, in view of the prevailing circumstances, to sanction the arrangement by which Mr. W. H. Birks, the council's surveyor, undertakes the work of inspector of nuisances until March 31st next, in addition to his ordinary work as surveyor, at an increase in salary of £30 for the period. The board also drew the notice of the council to the great necessity there was at the present time for the keeping up the sanitary condition of the country, and it was hoped that the attention of the sanitary inspector would be brought to the matter.

Weybridge U.D.C.—It has been agreed to accept the tender of the Rose Hose Company, Limited, at £46, for the supply of 1,000 ft. of new fire hose, and eight pairs of instantaneous couplings for £7.

Chadwick Public Lectures.—"Some Conclusions on Housing our Workers" was the subject of a Chadwick public lecture given by Mr. W. E. Riley, F.R.I.B.A., on Wednesday evening at the Royal Sanitary Institute. Sir William J. Collins, K.C.V.O., M.S., F.R.C.S., chairman of the Chadwick Trustees, presided. Particulars of Chadwick lectures may be obtained from the secretary, at the offices of the Chadwick Trust, 8 Dartmouth-street, Westminster.

West Hartlepool Officials and the War.—It was reported at a recent meeting of West Hartlepool Town Council that the general manager and a number of members of the tramways staff were desirous of joining his Majesty's Forces. The council decided that the working of the tramways be carried on under the superintendence of the electrical engineer and borough engineer (Mr. N. F. Dennis), and that no obstacles be placed in the way of other members of the staff enlisting. It was also agreed to engage women as conductors.

Hydraulics, Gauging of Sewage Flows, &c.—At the annual meeting of the Manchester District Branch of the Association of Managers of Sewage Disposal Works, held at the Mitre Hotel, Manchester, on the 6th inst., an instructive technical treatise on "Hydraulics, Gauging of Sewage Flows, &c.," was presented by Mr. Thos. Barlow, manager of the Denton, Lancs. sewage disposal works. The meeting was well attended, and the paper had a good reception, followed by a healthy discussion, in which the borough engineer of Rochdale, the managers of the Manchester, Salford, Bury, Leigh, and other sewage disposal works took part.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Shoeburyness U.D.C. (November 2nd. Mr. R. H. Bicknell).—£2,000 for the enlargement of the Rampart-street sewage tank.—It was explained that the sewage tank had at present a capacity of 8,400 gallons, and it was proposed to provide for an additional 24,600 gallons, making a total of 33,000 gallons. Mr. H. W. Gibson, clerk to the Kent and Essex Sea Fisheries Committee, said this scheme was proposed when there was a necessity for a proper sewerage system. The scheme might be a nice little makeshift, and perhaps the Local Government Board might say it was desirable because of the present difficulties, but his contention was that it would perpetuate what was now a nuisance. It was all very well to make shift by increasing the tank, but the nuisance on the foreshore would go on as before. The surveyor to the urban council, Mr. E. Read, stated in answer to Mr. Gibson that there was no system of sewage treatment. The sewage was simply gathered into the tank and discharged at certain states of the tide. Asked whether he was satisfied with the present system, Mr. Read said he was not or he should not have prepared the present scheme. Dr. Raper, the medical officer of health, said it was very desirable to enlarge the tank as suggested. The enlargement would allow of the sewage being run out at the proper time. Sometimes at present it ran out at improper times.

Warrington T.C. (November 10th. Mr. A. W. Brightmore).—This was an inquiry relating to an application by the corporation for a Provisional Order to provide for the abolition of the standard of illuminating power of gas supplied and the substitution of a calorific standard.—Mr. A. T. Hallaway, deputy town clerk, stated that when the corporation took over the gas undertaking the illuminating power was 16 candles. Since that period (1877) circumstances had undergone a great change. From the flat burner a change had been made to the incandescent mantle. He contended that the application, if granted, would be for the benefit of the consumer and manufacturer.

FORTHCOMING INQUIRIES.

NOVEMBER.	£
23.—**Bishopthorpe.** For works of sanitation (Mr. R. H. Bicknell)	—
24.—**Kingston-upon-Hull.** For the purchase of two motor fire engines (Mr. R. H. Bicknell)	2,665

APPLICATIONS FOR LOANS.

Belfast T.C.—£3,443 for services and meters.

Willesden U.D.C.—£100 for the extension of mains.

LOANS SANCTIONED.

Chesterfield Joint Hospital Committee.—£6,000 for the extension of Penmore Hospital.

Failsworth U.D.C.—£895 for sewage disposal works.

Grimsby T.C.—£3,903 for road widening.

Plympton St. Mary R.D.C.—£650 for the Lee Moor water supply.

Uckfield R.D.C.—£1,800 for the purchase of a site for the Mayfield outfall works.

Woking U.D.C.—£525, contribution towards the cost of rebuilding Hermitage bridge.

Institution of Electrical Engineers.—Mr. Charles P. Sparks last night delivered his inaugural address as president of this body.

The Road Problem in South Wales.—At a meeting last week of the committee appointed at the South Wales Housing and Town Planning Conference in July last to superintend a civic survey of South Wales and Monmouthshire, the city engineer of Cardiff, Mr. W. Harpur, emphasised the need of better communication between town and town as the most urgent problem in South Wales. The main trunk roads, particularly in the mining valleys, were deplorable, and had they been taken in hand in time there was no reason why they should not be sufficient for the traffic they were intended to carry.

PERSONAL.

Mr. H. C. Ashworth, deputy surveyor to the Crompton Urban District Council, has joined the Army.

Mr. T. L. Brown, burgh surveyor and sanitary inspector of Arbroath, has been granted leave to enlist in the Army.

Mr. John Dolan, deputy surveyor to the Roscommon County Council for the past fifteen years, has retired on a pension of £53 per annum.

Mr. F. E. Gay has been appointed acting surveyor of Bath, and the corporation have appointed a subcommittee to go into the question of the city surveyorship.

Messrs. R. W. Menmuir, town engineer, Woodstock, Cape Colony, and T. Salkield, chief engineer to the Delhi Municipality, have been elected Fellows of the Royal Sanitary Institute.

Mr. Clifford Hartley, son of Mr. T. H. Hartley, borough surveyor of Colne, Lancashire, who was serving his articles in his father's office, has been accepted into the Inns of Court Officers' Training Corps.

Mr. Oswald A. Bridges, engineer and surveyor to the Bognor Urban District Council, has had his salary increased to £300 per annum. By Christmas Mr. Bridges will be without an office staff, except his son, who is a pupil, and under military age.

Mr. Charles J. Jenkin, surveyor to the Finchley Urban District Council, who, in April last, obtained six months' leave of absence in order to go out to Serbia to organise and carry out sanitary work in the British hospitals there, has recently returned to Finchley. During his visit to Serbia Mr. Jenkin had an audience of King Peter.

Mr. G. Rawson, surveyor to the Worksop Urban District Council, has been appointed engineer to the water undertaking, in succession to Mr. G. Heaps, resigned, at a salary of £50 a year. Mr. Rawson has been voted £25 for preparing plans of the proposed extension of water mains, and for his services as water engineer *pro tem.* to October 31st.

Mr. E. G. Mawbey, borough surveyor and engineer of Leicester, has been the recipient of a letter of thanks and appreciation from the Oadby Urban District Council for the satisfactory manner in which he has acted as consultant engineer to the council in connection with the sewerage and sewage disposal works extension scheme recently sanctioned by the Local Government Board. The council have also placed on record their appreciation of the ability and efficient services rendered by their surveyor, Mr. Wm. Bell, in preparing the scheme.

Mr. W. C. Clifford Smith, M.INST.C.E., the distinguished engineer to the Asylums Committee of the London County Council, recently, as was recorded in our columns, suffered a sad bereavement in the loss of his son Dudley. We now learn that another son, Harold, who went to the Front in June, straight into the trenches, was early in August wounded by a bomb which was thrown and burst at his feet, shattering the left foot and smashing the big bones in the leg. His left arm was also injured. His leg has been amputated above the knee, and, unfortunately, later operations have been necessary, the last of them being performed only on Tuesday in the Queen Alexandra Hospital. He has borne his terrible sufferings with the most heroic fortitude.

Mr. William Blackshaw, formerly borough surveyor and water engineer of Congleton, has presented to the corporation of that town the plans and photographs of the Congleton waterworks. Alderman Maskery, who seconded the mayor's proposition that the gifts should be received with thanks, said he had a clear recollection of being associated in the work of the construction of the waterworks along with Dr. Beales, who was the chairman of the Water Committee at that time, and Mr. Blackshaw. They all felt this was a very appropriate gift which Mr. Blackshaw had presented to them, and they would value it very much as a memory of Mr. Blackshaw's connection with the town, and of the valuable work he carried out in the laying of the water mains and the construction of the waterworks over thirty years ago.

OBITUARY.

Mr. W. Morris, late district engineer of the Kent district under the Metropolitan Water Board, who retired from the service of that authority about six years ago, died recently, we regret to learn. Mr. Morris was in the service of the late Kent Waterworks Company and the board for over fifty years.

MR. ARTHUR ROWLAND BARKER.

Mr. Arthur Rowland Barker, a well-known architect, has died at Grove House, Southgate, at the age of seventy-three years. He was appointed in 1871 architect and surveyor to the diocese of Winchester. In that capacity he enjoyed the friendship of Bishop Wilberforce and Charles Kingsley. For more than forty years, and during six episcopates, he was a well-known and respected figure in the diocese. He had resided at Southgate since 1886, and was the architect of most of the principal local public buildings, including the municipal offices, schools, and the Baird Memorial Homes, as well as of schools at Waltham, Cheshunt, and Edmonton. He had been a member of the Middlesex County Council for three years, a Middlesex magistrate since October, 1904, a member of the Middlesex Education Committee, and a member of the local Burial Board.

BOROUGH SURVEYOR OF STRATFORD-ON-AVON.

Mr. Roden Dixon, borough surveyor of Stratford-on-Avon, died suddenly, we regret to state, on the 8th inst. He held the position of borough surveyor for nearly twenty years, and was highly esteemed by the members of the corporation and the ratepayers generally. The funeral, which took place on the 10th inst., was attended by the widow, daughters, and son-in-law. The town council were represented by the deputy mayor, Alderman Bird, Councillors Priest, Ballance, Fox, Kennard, Wimlett, Williams, Talbot, Burke, Howe, Smith, Bullard, and Deer. The town clerk, borough chamberlain, sanitary inspector, sewage works manager, librarian, custodian of town hall, the borough auditors, captain and lieutenant of fire brigade, members of borough surveyor's staff (Mr. A. E. Wiggett and Mr. R. Littlewood), Mr. W. Harris (general foreman), and a large body of corporation workmen also attended. The local Masonic Lodge was represented by Messrs. Webb, Broad, Fincher, Scriven, Stanton, Pearce, Smith, Wellstood, Justins, and Collins; and the borough surveyor of Evesham (Mr. H. Harvey) was present. The rural district council was represented by the clerk, and among others who took part were the sanitary and highway surveyors, and a large number of personal friends.

FOR OTHER ADVERTISEMENTS

See End of Paper.

BOROUGH OF STRATFORD-UPON-AVON.

BOROUGH SURVEYOR.

The Town Council propose to elect a Surveyor, at a commencing annual salary of £275, exclusive of out-of-pocket expenses.

Applications, stating age and past experience, with copies of not more than three recent testimonials, to be sent to me not later than the 13th December, 1915, endorsed "Borough Surveyorship."

Canvassing will disqualify. Definition of duties and further information may be obtained from

ROBERT LUNN,
Town Clerk.

Stratford-upon-Avon.
November 17, 1915. (2,769)

WOMBWELL URBAN DISTRICT.

ROAD MATERIALS, &c.

The Council invite Tenders for the Supply during the twelve months ending December 31st, 1916, of the following Materials—viz.:—

Granite, Limestone, Tarred Dross, Slag, Basalt, Dross Chippings, Limestone Asphalt, Cement, Setts, Kerb, Channelling, Flags, and Stoneware Pipes.

Further particulars and Forms of Tender may be obtained from Mr. W. Quest, Surveyor to the Council, Town Hall, Wombwell.

Tenders must be delivered to the undersigned, sealed and marked "Tenders for Road Materials," not later than Saturday, the 27th day of November, 1915.

PERCY MILNES WALKER,
Clerk to the Council.

Town Hall, Wombwell.
November 19, 1915. (2,770)

SOME RECENT PUBLICATIONS.*

The Elements of Surveying and Geodesy. By W. C. Popplewell, M.Sc., Assoc.M.Inst.C.E. Price 7s. 6d. nett. London: Longmans, Green & Co.

This book deals with surveying and geodesy in a very comprehensive and concise manner, and it can safely be recommended to students as one of the most useful works on surveying yet published. The author's large experience as a lecturer enables him to state his views clearly and concisely, and the book is written throughout in a way which indicates that he has a good grasp of this important branch of the surveyor's work.

The range of the book is so wide that few branches of the art of surveying are left untouched, dealing as it does with chain surveys, traversing, tacheometry, levelling, contouring, geodetic or trigonometrical surveying, geodetic astronomy, hydrographic and underground surveying, setting out railway curves, and earthwork calculations. The various instruments used by the surveyor are fully described, and those surveyors who as members of Kitchener's Army, the Territorials, or Volunteers, are serving their King and country in these stirring times, may be recommended to read this work for a much fuller description of the plane table, prismatic compass, and range finders, than is contained in the military manuals dealing with these subjects.

There are, however, a few directions in which in any future editions improvements will be desirable. The chapter on chain surveying, though in many respects very full and complete, might with advantage have been amplified by treating of town surveying. For many engineering purposes in this country large scale surveys and plans are required, and although the principles are practically the same, whatever the scale on which the survey is to be plotted, the care required, the details to be given, and the methods to be adopted vary considerably, according to the scale adopted for the plan. The specimens of a field-book given by the author might prove satisfactory on a 6-in. map, but not if plotted on the 1/2500 scale; while any surveyor adopting the system shown on pp. 24 and 25 of this book would simply be asking for trouble, and show his lack of experience in such work. The specimens of the field-book given are not worthy of the other parts of the book, and appear to have been the work of a student in the embryonic stage of a draughtsman and surveyor. The offsets shown are altogether too long for accurate work, and where the road lies outside the line the widths of the road are shown without a plus sign, which would lead most men plotting the work to regard the measurements as running or continuous measurements from the line. One of the first axioms that a surveyor should learn is to keep his lines as close as practicable to his details, so as to avoid long offsets. Long offsets are not only difficult to raise perpendicularly without the use of an instrument like the staff cross-head or optical square, both of which have practically fallen into disuse, but they are almost impossible to measure accurately with a staff, and they give trouble in plotting and lead to inaccurate work.

Contour lines are not shown on the larger scale Ordnance Survey plans, as stated in p. 133, for, although the 1/2500 and 1/500 plans give all the bench marks and numerous spot levels, the contours are not shown on these plans, but on the 6-in. maps.

A very useful chapter is given on tacheometry, and it is probably due as much to the excellence of the Ordnance Survey maps and plans, and the convenience with which they can be obtained and used, that tacheometry is not more used in this country.

A list of examination questions, a bibliography of surveying works, traverse tables, and logarithm and mathematical tables, and a very useful index, are also given at the end of the book.

Continuous and Alternating Current Machinery Problems. By W. T. Ryan. Price 2s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

This is a little book of questions, without answers, although in some cases notes as hints for solution are given. It is intended for use in technical schools in conjunction with a text-book or lecture course. In general the problems are very closely related to actual engineering practice, and are so made up as not to be mere mathematical puzzles.

*Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

An Eastern Sub-District meeting (Suffolk, Norfolk and Cambridge) will be held at Bury St. Edmunds on Saturday, December 4th.

Programme.

2 p.m.—Meet at Shire Hall, where the members will be received by Mr. W. Lionel Jenkins, Assoc.M.Inst.C.E., A.M.I.Mech.E., A.I.E.E., P.A.S.I., &c., county surveyor, West Suffolk County Council.
Read minutes of previous meeting.

2.30 p.m.—Mr. William H. Eley, Assoc.M.Inst.C.E., engineer and surveyor, Newmarket Urban District Council, will read a paper on "War-time Economy by Local Authorities," discussion.

4.30 p.m.—Afternoon tea at "Forrest Dean," by kind invitation of Mr. W. Lionel Jenkins.

Mr. Walter D. Harding, Assoc.M.Inst.C.E., borough surveyor and water engineer, Bury St. Edmunds, will be pleased to show, between 10 a.m. and 12 noon, any of the members who wish and communicate with him, the waterworks, electric power station and destructor.

Notices.

All members of the institution are cordially invited to attend, and in order that the necessary arrangements may be made, members must give notice of their intention to be present not later than Saturday, November 27th.

Friends of members will be welcome, provided permission is obtained from the president; names should in the first instance be sent to the sub-district secretary

J. R. Mead, *Hon. Sub-District Secretary.* H. T. Wakelam, M.Inst.C.E., *District Chairman.*

INSTITUTION OF MUNICIPAL ENGINEERS.

The seventh annual general meeting will be held in London on Saturday, November 27th.

Programme.

11.30 a.m.—Council meeting.
11.45 a.m. Meet in the council chamber, No. 4 Southampton-row, W.C.
12 noon.—Annual general meeting.
Minutes of last meeting.
Presentation of annual report of council.
Announcement of result of ballot for election of council for the year 1915-16.
Installation of president.
Any other business.
1 p.m.—Adjourn for lunch.
2.30 p.m.—Reassemble in council chamber.
2.45 p.m.—Presidential address.
Discussion on the following papers to be presented to the meeting:—
"The Manufacture of Cement," by Horace Boot (past-president).
"The Benefits Derived by an Urban District Adopting a Town-planning Scheme," by W. L. Carr (member).

Advance copies of papers may be obtained on application to the secretary, and will be forwarded as soon as the papers are in print.

Ladies are invited to attend the meeting.

B. Wyand, *Secretary.*
39 Victoria-street, S.W.

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

The fourteenth annual general meeting of this association will be held in the Caledonian Salon, Holborn Restaurant, London, on Thursday, December 9th, at 3 p.m.

Papers: "The Work Done at Salford by the Activated Sludge Process," by W. H. Duckworth, F.C.S., and "Recent Improvements in the Construction of Cultivative Tanks," by W. D. Scott-Moncrieff, M.I.Mech.E., F.R.S.I., past-president.

Discussion.

J. B. Croll, *Hon. Secretary.*

Re CLARMAC ROADS, LIMITED,

Tar Macadam Manufacturers,

3 Central Buildings, Westminster, London, S.W.

Works: Bradley, near Bilston, Staffs.
Chatterley, near Tunstall, Staffs.

FOR SALE BY TENDER, the STOCK-IN-TRADE, PLANT, MACHINERY, HORSES, CARTS and EFFECTS of the businesses of Tar Macadam Manufacturers, as carried on by the above Company at Bradley, near Bilston, Staffs, and Chatterley, near Tunstall, Staffs.

The Company's Works at Bradley, near Bilston, have good canal accommodation and are adjacent to the G.W. Railway Company's main line from Wolverhampton to Birmingham.

A Lease of the Slag Heap and Premises will be granted to a Purchaser.

The Works at Chatterley, near Tunstall, have, by arrangement with Mr. H. H. Williamson, access to the North Staffordshire Railway Company's main line, and have ample railway siding and canal facilities.

The Proprietors of the Slag Heap have undertaken to enter into Agreements with a Purchaser of the Works.

TENDERS must be delivered to the undersigned at Victoria Chambers, Stoke-on-Trent, not later than 12 o'clock noon on Monday the 29th inst. The highest or any tender will not necessarily be accepted.

For Forms and Conditions of Tender, Permission to view Premises and Stock-in-Trade, and for inspection of Terms of Lease and Agreements apply to the undersigned,

F. W. CARDER,
Chartered Accountant,
Receiver for Debenture Holders.

F. GEEN & CO.,
Stoke-on-Trent.

INSTITUTION OF WATER ENGINEERS.

The twentieth annual winter meeting will be held at the Geological Society's apartments, Burlington House, W., on Friday, December 10th, commencing at 2.30 p.m. A discussion will be invited on "The Necessity for Defining the Term 'Domestic Purposes' in General and Private Water Acts."

The election of the president and council for the year 1916-17, also the election of the auditors for the year 1916 will take place at this meeting.

PERCY GRIFFITH,
Secretary.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

ENGINEER-IN-CHARGE.—November 22nd.—Thakeham Rural District Council. 32s. per week.—Mr. Percy Ayling, clerk, Council Offices, Storrington, Sussex.

FIRE BRIGADE SUPERINTENDENT.—November 26th.—Merton Urban District Council. £100—£140 per annum.—Mr. C. J. Mountfield, clerk, Kingston-road, Merton.

BOROUGH SURVEYOR.—December 13th.—Stratford-upon-Avon Corporation.—Mr. R. Lunn, town clerk.

STEAM ROLLER DRIVER.—Bromsgrove Rural District Council.—Mr. Chas. E. Cox, highway surveyor, Clent, near Stourbridge.

DRAWING OFFICE ASSISTANTS.—In a Government Department (London). £150 per annum.—Box No. 454, care of Streets, 8 Serle-street, London, W.C.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

LANARK.—November 25th.—For the execution of digger, brick, concrete, joiner, glazier, slater, plumber, gasfitter, plaster, and painter work in connection with the erection of 150 dwellings, for the District Committee of the Middle Ward.—Messrs. Shearer & Marr, 219 St. Vincent-street, Glasgow.

ASHTON-UNDER-LYNE.—November 29th.—For one 100-gallon pneumatic ejector for humus sludge, for the corporation.—Mr. J. Rowbottom, engineer, Town Hall.

KILKENNY.—November 30th.—For the construction of a reinforced-concrete bridge, for the Kilkenny and Wexford County Council.—Mr. A. M. Burden, county surveyor, Kilkenny.

Engineering: Iron and Steel.

DUNDEE.—November 23rd.—For the construction of steel roof span for the new city hall, for the corporation.—Mr. J. Thomson, city architect.

KIRKCALDY.—November 24th.—For supplying 1,600 tons of dry, sand-cast iron pipes, and special castings from 12 to 6 in. diameter, for the Kirkcaldy District Committee.—Messrs. J. & A. Leslie & Reid, engineers, 72A George-street, Edinburgh.

CHIPPENHAM.—November 25th.—For sale, a 15-ton steam roller, with Morrison's scarifier attached.—Mr. A. H. Lapham, surveyor, Corsham, Wilts.

MANCHESTER.—November 26th.—For the supply and erection of a steam heater to drying-rooms; also at Baguley sanatorium of ten drying-horses and steam heater, for the Sanitary Committee.—City Architect, Town Hall.

SALFORD.—November 29th.—For the supply of manganese steel crossings, for the corporation.—General Manager, Corporation Tramways, 32 Blackfriars-street, Salford.

ATHENS.—December 17th—30th.—For the maintenance and working of the undertakings necessary for the water supply, and laying a distributing system.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

JOHANNESBURG.—December 30th.—For the supply and erection of ice-making and refrigerating plant, for the municipal council.—Intelligence Branch of the Board of Trade, 73 Basinghall-street London, E.C.

Roads.

WELLINGTON.—November 22nd.—For steam rolling and scarifying, for the urban district council.—Mr. W. H. Ham, clerk, 26 High-street.

EDMONTON.—November 22nd.—For the supply of about 100 tons of tarred slag macadam and tarred granite macadam, for the urban district council.—Mr. C. Brown, engineer, Town Hall.

WANDSWORTH.—November 22nd.—For making up and paving Heathfield-road, for the borough council.—Mr. P. Dodd, borough engineer, 56 East-hill, Wandsworth, S.W.

ROMFORD.—November 23rd.—For the supply of 550 tons of broken granite, for the urban district council.—The Surveyor, Council Offices, Market-place, Romford.

EPSOM.—November 24th—30th.—For the supply of about 35,000 gallons of dehydrated tar, and 80,000 gallons of refined tar in barrels or tank wagons, for the rural district council.—Mr. T. E. Ware, surveyor, Waterloo-road, Epsom.

WARWICKSHIRE.—November 25th.—For the supply of road material, broken and unbroken, and tarred macadam, for the county council.—Mr. John Willmot, county surveyor, 6 Waterloo-street, Birmingham.

MERTON.—November 26th.—For the supply of broken granite, for the urban district council.—Mr. G. Jerram, surveyor, Council Offices, Kingston-road, Merton, S.W.

WOMBWELL.—November 27th.—For the supply of road materials, &c., for the urban district council.—Mr. P. M. Walker, clerk.

WHITLEY.—November 29th.—For the supply of team labour for various departments, for the urban district council.—Mr. A. J. Rousell, surveyor, Whitley Bay, Northumberland.

HAMPTON WICK.—December 3rd.—For the supply of about 200 yds. of granite, for the urban district council.—The Surveyor, Council Offices, High-street, Hampton Wick.

BRENTFORD.—December 4th.—For the supply of 200 yds. of blue Guernsey or other approved granite, for the urban district council.—Mr. J. W. Croxford, surveyor, Clifden House, Boston-road, Brentford.

GLANFORD BRIGG.—December 4th.—For making up certain streets and back roads, for the rural district council.—Mr. W. H. Buttrick, engineer, High-street, Scunthorpe.

SKEGNESS.—For constructing surface-water sewer and road foundations, for the urban district council.—The Surveyor.

FINCHLEY.—For the supply in barrels of about 55,000 gallons of tar, and gritting material, for the urban district council.—Engineer and Surveyor, Council Offices.

Sanitary.

MANCHESTER.—November 22nd.—For the construction of 2-in. stoneware pipe sewers in certain streets, for the corporation.—City Surveyor.

AUDENSHAW.—November 23rd.—For hiring horse and man for the removal of refuse, for the urban district council.—Chairman, Sanitary Committee, 2 Guide-lane, Audenshaw, Lancs.

FLAXTON.—November 25th.—For removing and disposing of refuse in the village of Strensall, for the rural district council.—Mr. J. White, sanitary inspector, 4 New-street, York.

GLASGOW.—November 27th.—For the construction of pipe sewers and roads, for the corporation.—Office of Public Works, 64 Cochrane-street.

PRESTWICH.—November 29th.—For the construction of a 12-in. sewer, for the urban district council.—The Surveyor, Chester Bank.

SPALDING.—December 4th.—For work in connection with the disposal of sewage, for the board of guardians.—Mr. H. Stanley Maples, clerk.

GILDERSOME.—December 6th.—For emptying and cleansing ashpits, for the urban district council.—The Surveyor, Council Offices.

CHEPPING WYCOMBE.—December 6th.—For the supply of stoneware pipes, for the corporation.—Mr. T. J. Rushbrooke, borough surveyor.

Stores.

CHATHAM.—November 24th.—For the supply of goods and materials, for the corporation.—Borough Surveyor, Town Hall.

OTLEY.—December 31st.—For the supply of setts, kerbs, flags, granite macadam, pitch, tar, slag dust, tar-macadam, limestone macadam, and brushes, for the urban district council.—Mr. C. F. Hodgson, surveyor.

RHONDDA.—November 30th.—For the supply of stoneware pipes for sewers and surface-water, bass brooms, rotary brushes, ironmongery, picks, shovels, road scrapers, tools, steel standards, iron castings, street gratings, manhole covers, paving, kerb, channel, pitching and coping, Portland cement, granite road macadam, and limestone macadam, for the urban district council.—Mr. E. H. Barber, engineer and surveyor, Council Offices, Pentre, Rhondda.

NOTTINGHAM.—December 2nd.—For the supply of blue bricks, stoneware pipes, castings, iron gullies, Yorkshire flags, kerb, granite setts, broken granite, ironstone slag, chippings, river gravel, ironmongery, and refined tar, for the corporation.—Mr. A. Brown, city engineer.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.
‡ Provisionally accepted.

TWICKENHAM.—The following tenders have been accepted by the urban district council:—

Alexandra Paving Stone Company, Limited.—Supply and delivery at Twickenham Station of 600 yds. super. of 2-in. Alexandra stone paving slabs, at 7s. 4d. per yard super.

Rowe & Mitchell.—One large load (about 100 cubic yds.) of granite siftings, delivered alongside at Church drawdock, at 15s. 10d. per cubic yard.

Leyland Motors (1914), Limited.—Supplying and fitting weldless steel tyre, set of fetloes, bolts, and bush to hind wheel, and new weldless tyre to front wheel of steam wagon, at £16 7s., plus 10 per cent.

G. & T. Gravestock.—Repairs to tip-carts (Nos. 30 to 40 inclusive), as per detailed specification, at £56 8s. 9d.; rebuilding new body to No. 21 dust van, as per detailed specification, at £18 10s.

G. Slark.—Supply and delivery of twenty-four dozen chemically-treated pure Bahia bass brooms, as per sample, at £37 1s. 7d.

W. & F. Archer.—Delivery of two dozen 21-in. mixed wire and bass brooms, medium texture, complete with handles and iron stays, at 6s. 9d. each, plus 10 per cent.

Arad Feather.—Supply and delivery of 240 gallons of disinfectant fluid, guaranteed equal in germicidal efficiency to pure carbolic acid, at 1s. 2d. per gallon

BLAST FURNACE SLAG
From 1¼ cwt. to 2¼ cwt. per cubic yard

FOR SEWAGE FILTERING

Supplied from ⅛ in. upwards. FREE FROM DUST. REQUIRES NO WASHING. PROVED AFTER 9 YEARS' WORKING NOT TO DISINTEGRATE, and to give excellent effluent.

JOHN FREAKLEY & CO., Ltd., Coneygre Slag Works, DUDLEY PORT, TIPTON. Telegrams—"Freakley, Tipton." Telephone—No. 3 Tipton.

ROAD MAKING

REINFORCE CONCRETE ROADS WITH

EXPANDED METAL

PORT TALBOT: Roadway over Colliery Workings, Margam Park. Mr. William Jardine, Engineer.

THE EXPANDED METAL COMPANY, LTD.
(Patentees and Manufacturers of Expanded Metal.)
Head Office: YORK MANSION, YORK STREET, WESTMINSTER, LONDON, S.W.
Works: STRANTON WORKS, WEST HARTLEPOOL.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

NOVEMBER.

27—Institution of Municipal Engineers: Annual General Meeting in London.

DECEMBER.

1.—Institute of Sanitary Engineers: Dr. W. E. Adeney on "The Disposal of Sewage by Dilution: A Bio-Chemical Method."

4. Institution of Municipal and County Engineers: Eastern Sub-District Meeting at Bury St. Edmunds.

9. Association of Managers of Sewage Disposal Works: Annual Meeting, Holborn Restaurant. 3 p.m.

10.—Institution of Water Engineers: Annual Winter Meeting, Burlington House, W. 2.30 p.m.

APPOINTMENTS OPEN.

BROMSGROVE RURAL DISTRICT COUNCIL.

STEAM ROLLER DRIVER.

The above Council invite applications for the appointment of Driver of Steam Road Roller.

Applications, stating age, experience, and wages required, accompanied by copies of two recent testimonials, to be sent to the undersigned.

CHAS. E. COX,
Highway Surveyor.

Surveyor's Office,
Clent, near Stourbridge.
November 9, 1915. (2,760)

APPOINTMENTS WANTED.

GENERAL ASSISTANT (Municipal Engineering) seeks re-engagement; 14 years' experience in Provincial Office (pop. 125,000), in all branches. Beyond Military age. — Box 1,544, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (2,757)

TENDERS WANTED.

BOROUGH OF ASHTON-UNDER-LYNE.

SEWAGE DISPOSAL WORKS RECONSTRUCTION.

The Corporation are prepared to receive Tenders for one 100-gallon Pneumatic Ejector for Humus Sludge.

Specification and all particulars can be obtained from the Engineer, Mr. J. Rowbottom, Town Hall, Ashton-under-Lyne.

Tenders, in official envelopes, to be delivered to the undersigned not later than first post on November 29, 1915.

The lowest or any Tender will not necessarily be accepted.

J. NEAL,
Borough Comptroller.

Town Hall
Ashton-under-Lyne.
November 15, 1915. (2,766)

OTLEY URBAN DISTRICT COUNCIL.

The above Council are prepared to receive Tenders for the following Materials for the year ending March 31st, 1917:

1. Setts, Kerbs and Flags.
2. Granite Macadam.
3. Pitch and Tar.
4. Slag Dust.
5. Tar-macadam.
6. Limestone Macadam.
7. Brushes.

Specifications and Forms of Tender can be obtained from Mr. C. F. Hodgson, Surveyor to the Council, and to whom Tenders must be sent not later than Friday, the 31st day of December, 1915.

The Council do not bind themselves to accept the lowest or any Tender.

C. J. F. ATKINSON,
(2,765) Clerk.

Before placing your order for Municipal Vehicles obtain particulars of "Hallford" Motor Wagons, which have given complete satisfaction to many Municipal Authorities.

HALLFORD
MUNICIPAL MOTOR WAGONS

Combined Street Watering & Dust Collecting Carts, Tipping Wagons, Tower Wagons, Prison Vans, Fire Tenders, &c.

WRITE FOR CATALOGUE "L" FOR FULL PARTICULARS.

10 ST. SWITHIN'S LANE, LONDON, E.C. J. & E. HALL, LTD. DARTFORD, KENT.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. NOVEMBER 26, 1915. No. 1,245.

Minutes of Proceedings.

Electricity Supply.

The inaugural address delivered last week by Mr. [illegible] dent of the Institution of Electrical Engineers, [illegible] the history and present position of electricity supply in this country. It is difficult to realise in these days, when electricity plays such a large part in our daily life, that it was only in 1879 that the electric supply industry became possible by the invention of the carbon filament lamp. The new industry was not treated very kindly by Parliament, the actual effect of the early legislation—intended, no doubt, in the public interest—being to stifle rather than to develop it. Indeed, while electricity supply was being put upon a commercial basis in America and on the Continent, manufacturers in Great Britain, unable to proceed with the equipment of undertakings operating under statutory powers, had either to turn their attention to the equipment of separate works with lighting and power, or to operate without statutory powers by using overhead wires, permission for these being secured by private wayleaves of uncertain tenure. By this method of development the electric supply industry was started on unsound lines in this country, and the effects of this false start are still felt. Nowhere, perhaps, is this more true than in the Metropolis. This area has been sub-divided between so many electrical undertakings that the question of general supply cannot be considered from an engineering point of view. The present position arises through a series of initial mistakes, and future improvement is more a matter of adjusting numerous municipal and other vested interests than an engineering question. In view of the successful results obtained in this country outside the Metropolis by concentration and the recognised practice of the rest of the world in allowing one authority to operate over a large area from a minimum number of power stations, there is little to be said on the London question from an engineering point of view. Mr. Sparks, however, pointed out two practical difficulties. First, owing to the large sums invested by a number of separate undertakings in small power stations and special distributing systems, any comprehensive scheme must suffer a disadvantage in the first instance due to the added cost of new high-pressure network and conversion plant. Second, reliability of supply being of the first importance, and of far greater importance than the supply at a minimum cost, it would be unsafe to supply the Metropolis from a few stations.

Having traced the main engineering features which have contributed to improved results since the passing of the Electric Lighting Act of 1888, Mr. Sparks concluded his address by indicating some of the main directions in which future development may be looked for. In the first place he pointed out that general development may be expected owing to the increasing realisation of the necessity for economising the national fuel supply. Hitherto the economical use of fuel has been hindered in this country by its low price. Only a fraction of the total coal consumed is at present used for centralised sources of supply [illegible] power and heat, and the principal future economy in fuel will be found in the increasing use of such centralised supply so as to avoid waste in the consumption of coal. Mr. Sparks was very optimistic in regard to the future of lighting, and said that, apart from hygienic reasons, it is certain that electricity will prevail more and more as an illuminant owing to the greater number of candle-power hours that can be obtained from a ton of coal by using electricity as compared with gas. If it be suggested that further improvements in the gas mantle will equalise matters, it must be remembered that electricity is more than holding its own in the matter of improved lamps. Finally, in speaking of domestic uses, Mr. Sparks pointed out that there is no section of the general supply that opens up greater possibilities than electric cooking and heating, since at a low estimate the units required for these purposes would be ten times those required for lighting. Moreover, a development in this direction would utilise to much greater advantage the distributing mains in residential areas, which are at present only fully loaded during a few hours each day. As a whole, the address was based upon the long view which characterises the statesman, and it was received with great attention and interest.

Deep Percolating Filters.

From tests made some time ago it appeared that the limit of economy in the construction of percolating filters was reached with an effective depth of 9 ft. Since that time the investigations

carried out by Mr. H. W. Clark, chemist in charge of the Lawrence (Mass.) Experiment Station, indicated that a filter 10 ft. deep could deal with sewage at a rate at least six or seven times as great as a filter 4 ft. in depth, and still produce an effluent as well purified as the effluent from the shallow filter. Later investigations have shown that the reasons for this unexpected difference in the capacity of shallow and deep filters are connected with the holding up of the liquid in the interstitial spaces of the filter and its displacement by the fresh sewage applied at the surface. These reasons, and the methods by which they were discovered, are described very clearly in a paper presented by Mr. Clark at a recent convention of the American Public Health Association, and printed on another page. The methods adopted in this investigation are extremely interesting and conclusive, and the net result is that, while producing effluents of practically identical purity, a filter 10 ft. deep treated the sewage at the rate of about 200 gallons per cubic yard per day, while a 6-ft. deep filter was not capable of dealing with more than about 80 gallons per cubic yard.

The importance of these experiments cannot be over-estimated, as it opens up the question of the best manner in which to utilise ample fall at a sewage works where it is available. In a number of such cases in the past preference has been given to double filtration in two series of comparatively shallow filters—say each 5 ft. in depth, instead of one series of filters 10 ft. in depth. This has, of course, been done with the view of producing a better effluent than was considered possible in a single series of filters. If, however, Mr. Clark's figures apply generally, the 10-ft. filter can deal with five times the quantity treated on a 5-ft. filter, and, if the volume delivered to a 10-ft. filter were reduced by 50 per cent in order to secure an effluent of a higher quality, a single series of 10-ft. filters would still deal with 2½ times the quantity, which could be treated on two series of 5-ft. filters. It is thus clear that for a given volume of sewage by using a single series of 10-ft. filters the total cubic capacity would be only two-fifths of that which would be required if two series of 5-ft. filters were constructed, and the actual saving in first cost would probably amount to 50 per cent. It may be argued that the foregoing deductions apply only to American sewage, or even only to the Lawrence sewage, but the differences are so great that it is fairly certain that if we only had a similar authority in this country capable of carrying out similar investigations the results with English sewage would be very similar. Even if they fell considerably short of those set forth by Mr. Clark, they would still demonstrate the importance of giving very careful consideration to the relative capacity of deep and shallow filters in places where the fall available is sufficient for either to be adopted.

* * *

Heavily Loaded Wheels on Highways.

The damage caused to road surfaces by the contact of the wheels of vehicles which are so heavily loaded as to cause excessive pressure has become so serious that the problem of devising some remedy for the evil is one of great urgency. In an article which he has contributed to the *Journal* of the Institution of Municipal and County Engineers, Mr. A. E. Collins, the city engineer of Norwich, approaches the question from the point of view of improved wheel construction, and gives details of some ingenious devices which he has designed with the object of automatically securing the maximum area of contact between tyre and road surface independently of the camber of the road traversed. It is evident that damage to roads from the cause indicated will be reduced to a minimum if, where wide wheels are necessary, they can be so constructed or mounted as to press equally upon the road for the whole width of the wheel. As Mr. Collins points out, indiarubber tyres, provided they are not too hard, practically effect this distribution on roads of average cross-section or camber, whereas wide iron or steel tyres only do so on roads of the one particular camber they are made to suit. If they run on a road of greater camber they will run on their inner edges, so causing a greatly increased intensity of pressure over a reduced area of contact, while in the case of a road of less camber a similar result is produced at the outer edges. It thus appears that if road surfaces are to be satisfactorily maintained iron or steel tyres should not be permitted where they exceed a certain width (Mr. Collins puts this at 9 in.) unless the wheels are so arranged as to adapt themselves to the constant variations in camber which they are bound to encounter. Mr. Collins proposes to meet this difficulty by means of devices the aim of which is to permit each wheel to have a limited sideways rocking motion enabling the tyre to conform with the cross-section of the portion of the road it presses upon. He gives three alternative designs, two of which are applicable to cases in which the axle of the wheel on one side of the vehicle is not connected to that on the other, while the third is applicable to a vehicle having a propeller drive. There can be no doubt that the general adoption of Mr. Collins's ingenious invention would result in the saving of very large sums which are at present expended by highway authorities throughout the country, and at the same time would permit of economies to road users owing to the greater loads which could be carried with safety and economy.

* * *

Water Pollution Dangers.

The investigation by Dr. Morgan Rees, of the Local Government Board, of the causes of an extensive outbreak of diarrhœa which occurred recently in certain parishes in the Blackwell Rural District, pointed clearly to the association of the epidemic with a pollution of the public water supply. This was first regarded with suspicion, because the two parishes affected, and these alone, are secured by a common water supply, which reaches them from a service reservoir which does not supply any other district. But the way in which this suspicion became a certainty is not a little remarkable. It appears from Dr. Rees's report that on March 19th, the same day as that on which the medical officer was informed that the outbreak was increasing, a sewer belonging to the Huthwaite Urban District Council, and crossing over the water main leading from Huthwaite to the Blackwell Rural District some 50 yds. west of the reservoir, was found, on excavation, to be fractured. Its condition was suspected on March 17th by Mr. Bostock, the surveyor and inspector of nuisances of the Huthwaite Urban District, who found on that date sewage overflowing from an adjoining road gully. The matter was reported to the surveyor of the Blackwell Rural District by Mr. Bostock. The latter declined responsibility for repair of the sewer, alleging that the sewer which was laid down in 1890 by the Huthwaite Local Board had given way owing to neglect on the part of the Blackwell Rural District Council to give proper support to the sewer at the time when their water main was laid down in 1892. To avoid unnecessary delay Mr. Silcock promptly and rightly took upon himself to repair the sewer. The sewage was diverted by temporary means on March 19th, but some days elapsed before the sewer was fully restored. The

immediate result of the repair of this sewer was a considerable abatement in the epidemic, and it was subsequently demonstrated beyond doubt that the infection had found its way into a defective by-pass which was connected with the water main. The complete success of the investigation conducted by Dr. Rees affords another example of the valuable work accomplished by the Local Government Board in assisting local authorities in the discharge of their duties.

Crude Tar on Highways.

In March last a circular letter was issued by the Road Board impressing upon local authorities the importance of using only refined or distilled tar in connection with works of road maintenance and improvement. The reason for this request was that certain tar products which are obtained by the distillation of the crude material are required in the manufacture of explosives of supreme importance at the present time. It has, however, now been found necessary to issue further circulars on the subject, and these have been addressed to county councils and to both urban and rural authorities. It appears that the use of crude tar for road work still continues in certain districts, and, although this is mainly attributed to the fact that the first circular was issued after road tarring operations had either commenced, or contracts had been entered into by which quantities of crude tar had been purchased, it is felt by the board that it may be partly due to a failure on the part of those concerned to realise the importance of the matter. It is now made clear once and for all that the continually increasing demands for coal tar products for the manufacture of explosives must necessitate the impossibility of the continued supply of the crude material shall be overlooked. The present circulars, which have been issued at the instance of the Ministry of Munitions, call upon every highway authority to see that arrangements are promptly made which shall absolutely prevent the use of crude tar upon highways and footways during the continuance of the war, whether for spraying, painting, grouting, or the manufacture of tarred macadam, taking care that, if the latter material be supplied by contractors, only refined tar shall be used in its preparation. This is sufficiently emphatic and comprehensive, and once the need is realised we have no doubt that municipal engineers and surveyors throughout the country will loyally co-operate to secure the desired end.

* * *

Main Roads in Ireland.

The main road question in Ireland would seem to be in a state of flux, the point of issue with the county councils being whether, so far as they are concerned, they should be abolished and their maintenance made a purely district charge. The Mayo County Council decided to abolish the main roads, but before doing this it caused inquiries to be made, and ascertained that in sixteen counties main roads had been abolished, that nine counties continued the system, while eight counties did not send a reply to the communication. The subject has been investigated at a Local Government Board inquiry held recently, and it was urged by objectors that the main road system rendered the burden of maintenance unequal. On the other hand it was argued that where the cost of maintaining main roads fell upon the local authority an injustice was created where the roads were used mainly by through traffic. The point with respect to inequality was pressed by the county surveyor for South Mayo, Mr. E. K. Dixon, who also contended that from the entire county direct labour schemes, which he favours, cannot be worked successfully in the county area. In the circumstances he considers that direct labour schemes should be carried out by the district councils. The difficulties of the position—or eccentricities, whichever you please—are instanced by the candid declaration of the county surveyor for North Mayo, Mr. J. J. Neilan, that it was mainly a case of robbing Peter to pay Paul. It is quite natural, of course, that such an anomalous state of things should be keenly resented by Peter, to whom the fitness of things must still be an abiding ideal. How such a system came into existence it is not for us to say. Like Topsy, it probably "growed," and for that reason it must be a continuous source of vexation to those who are brought into contact with it. Mr. A. E. Saunderson, the Local Government Board inspector, who officiated at the inquiry, may be expected to find a remedy which, if not perfect or scientific, should at least be more logical and fair than the existing system. After all, there are examples of county administration which, if not quite frictionless, are still preferable to that which obtains in Ireland.

* * *

The War and Engineering Industry.

Last winter a series of debates was held at the Manchester Engineers' Club to discuss the effect of the war on engineering industry. The ultimate result was the appointment of a special committee to consider the whole matter and to report fully to the club. This committee has now presented its report, which contains detailed recommendations for the formation of an association based upon a recognition of the interests common to competing firms and common also to employer and employed. It is suggested that the association should comprise British manufacturing concerns in all branches of engineering, aim at the inclusion of every such concern, have a constitution giving it a legal status framed on broad principles, and possess an efficient and energetic management. Such an association would speak with a powerful collective voice in matters with which Parliament was concerned, would assist the Government in questions connected with industry and commerce, and would be entitled to representation on the governing bodies of universities and technical colleges. The association would not trade in any way whatever. It would assist members equally and without distinction in the obtaining of business, and would generally act in the furthering of the interests of the industry as a whole. In support of this far-reaching recommendation, the special committee point out that they are convinced that half measures would not command general support, and that, in any case, they would be no more successful in the future than they have been before. The aim is not *an* organisation to give the engineering industry some degree of help, but *organisation* of the whole engineering industry that it may help itself.

Housing After the War. The provision of housing accommodation for the working classes after the war engaged the attention of a conference of garden city authorities last Friday. The conference was held to consider what steps should be taken in view of the difficulties in regard to finance and the provision of material. Mr. Cecil Harmsworth, M.P., who presided, said they had to face the prospect of dear money, possibly dear labour, and, for some time at all events, having regard to the competition that must be set up when the rebuilding of Belgium, parts of France and Poland took place, dear material. "Those of us who are not engaged in military service," added Mr. Harmsworth, "cannot do better than devote our energies to making every possible prudent and far-sighted plan to meet the condition of affairs that will arise when, happily, the war comes to a conclusion."

C

Economy of Deep Percolating Filters.*

By H. W. CLARK, Chemist in Charge of the Lawrence, Mass., Experiment Station.

In an article entitled "The Depth of Filtering Material and Trickling Filter Efficiency," read before the Boston Society of Civil Engineers last winter, I presented the rate-efficiency results of a number of trickling filters which have been in operation at the Lawrence Experiment Station for periods of from two to sixteen years. In that paper I showed that, judging from the Lawrence data, a trickling filter 10 ft. in depth could receive sewage at a rate at least six or seven times as great as a trickling filter 4 ft. in depth, and still produce an effluent purified as well as the effluent from the shallow filter. Further, a trickling filter 10 ft. in depth could be operated at a rate at least five times as great as a 5-ft. trickling filter, and give equal purification results. That is to say, doubling the depth of a trickling filter increases its rate-efficiency at least five times. This being so, I urged the great economy resulting from the construction of deep instead of shallow filters of this class.

The accompanying table illustrates the rate and results of the operation at Lawrence of four trickling filters, 4, 6, 8 and 10 ft. deep, respectively.

AVERAGE ANALYTICAL DATA—EFFLUENTS, MARCH, 1915.
(Parts in 100,000.)

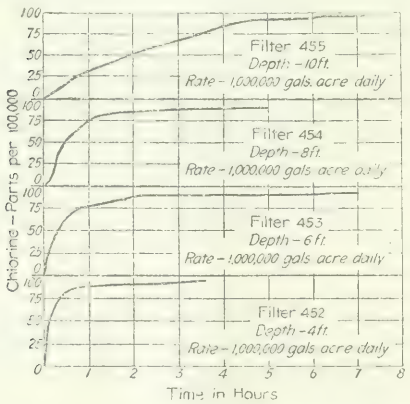
Filter No.	Depth of filter (feet).	Rate, gallons per acre daily	Ammonia, albuminoid. Free.	Total.	In solution	Chlorine.	Nitrogen as Nitrates.	Nitrites.	Oxygen consumed.	Per cent of samples stable
452	4	490,375	1·0675	·3413	·2180	12·65	1·15	·0045	2·50	80
453	6	784,625	1·2088	·2663	·1880	12·55	1·19	·0313	1·80	100
454	8	1,371,250	1·6857	·3882	·2260	12·10	1·45	·0097	2·25	100
455	10	3,200,000	1·7625	·2925	·2110	11·85	1·19	·0017	1·90	100

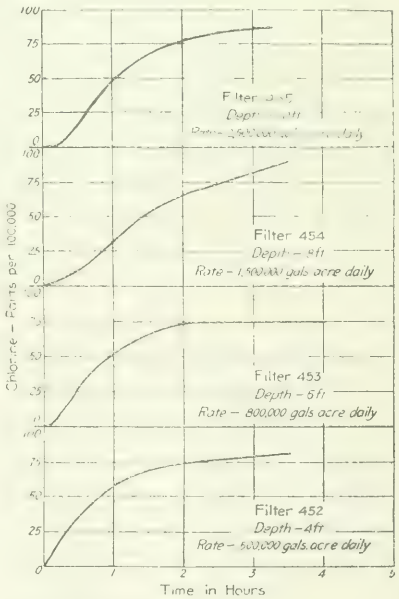
HYDRAULICS OF FILTER FLOW.

After looking at these results, the question, of course, arises as to the cause of the great rate-efficiency of the deeper filters. Why should a filter 10 ft. deep allow not simply a rate 2½ times as great as a 4-ft. filter with equal purification, but a rate 5 or 6 times as great? The explanation, when worked out, is comparatively simple, and shows these striking results to be due simply to the hydraulics of the flow of the sewage through the filtering material. Twenty-five years ago, in the special report of the Lawrence Experiment Station, the flow of water through sand filters was described (Special Report for 1890, "Purification of Sewage and Water," by Hiram F. Mills, C.E., page 18). This description, based upon experiments then made, showed that when water or sewage is applied to a sand filter which, at the time of application, contains much water in its interstitial spaces, some of the applied water will, especially in filters of coarse sand, pass by the held interstitial water instead of pushing it before it, and appear at the filter outlet ahead of a large percentage of the held water. This held water is really partly interstitial water and partly absorbed water—that is, water held or absorbed by the organic matter lodged in the filters.

Now the rate and purification results in the operation of trickling filters of different depths have to do with this flow of water, and the proper admixture of the applied with the held water in filters of broken stone or other coarse material, and with filtering depths varying in the cases cited in this paper from 4 ft. to 10 ft. In the early work only sand filters 5 ft. in depth were studied.

In this recent work I have revealed a factor not noticed in the sand filter studies of twenty-five years ago, which affects the results very materially. This is the simple fact, made clear by the recent work, that the deeper the trickling filter up to a certain point the greater the tendency of the applied water to





TIME OF PASSAGE THROUGH FILTERS UNDER DIFFERENT CONDITIONS.

mix or mingle with the held water instead of passing by this held water. This tendency to mingle as the filter depth increases, and to push the held water toward the underdrains is great enough to cause a large percentage of sewage passing through a 10-ft. filter to be not simply twice as long in passing as through a 5-ft. filter, but five or six times as long. Conversely, the rate of the deep filter may, on account of this condition, be from five to six times that of the

* Paper presented at Convention of American Public Health Association, and reproduced from New York *Engineering Record*.

shallow filter with equal purification results. This is illustrated by the accompanying diagrams.

EXPERIMENTS AT LAWRENCE.

We have on these diagrams data from experiments made by me at Lawrence in regard to the flow through the four trickling filters; the rate and purification results are shown in the table for filters 452 453 454 and 455, which are 4, 6, 8 and 10 ft. deep respectively. On the first diagram we have the results shown when each filter was being operated at the rate of 1,000,000 gallons per acre daily. In order to determine the time of passage of the water or sewage through the filters operated at this rate, and the degree of mingling of applied and held sewage, enough salt was placed at a definite time in the applied sewage to raise the chlorine 100 parts in 100,000, this amount, of course, being readily detected in the filter effluent. Increased chlorine in the effluent, due to the large application, was detected with equal readiness.

After the application of this salt sewage to each filter, samples of the effluent were collected every few minutes for the determination of chlorine. An examination of the diagrams will show that 50 per cent of the salt sewage applied to filter 452 appeared at its outlet in about twelve minutes mingled with 50 per cent of the held sewage—that is, the chlorine had increased to 50 parts or more in 100,000 parts. With the 10-ft. filter operating at the same rate, one and three-quarter hours elapsed before an effluent containing 50 per cent of the salt sewage reached the underdrains—that is, instead of being two and a-half times as long, or thirty minutes, most of this salt sewage was nine times as long in passing the deep as in passing the shallow filter. The results are given with four filters, and, for clearness, the flow may be summarised as follows:—

RESULTS SUMMARISED.

With a 4-ft. filter, as stated, 50 per cent of the salt sewage appeared at the outlet in twelve minutes, 75 per cent in eighteen minutes, and the remainder came slowly mingled with the "held" sewage through many hours. With filter 453, 6 ft. in depth, 50 per cent appeared in eighteen minutes, 75 per cent in forty-two minutes, and the remainder appeared as with the first filter mingled with the held sewage through many hours. With filter 454, 8 ft. in depth, the elapsed times were forty-eight minutes and 1½ hours respectively, while with the 10-ft. filter, as stated, the elapsed times were 1¾ hours and 3½ hours respectively.

In other words, with equal rates of operation, 50 per cent of the sewage applied to the 4-ft. filter reaches the filter outlet mingled with 50 per cent of the held sewage twelve minutes after its application, while with the 10-ft. filter 125 minutes elapse before 50 per cent of the applied salt sewage reached the filter outlet mingled with 50 per cent of the held sewage.

It follows, then, that at this rate, 1,000,000 gallons per acre daily, 50 per cent of the sewage is subjected at the most to only twelve minutes bacterial action in the 4-ft. filter, while in the filter 10 ft. deep, 50 per cent receives, at the most, 125 minutes bacterial action.

Now to reverse the application of the data gained in this way, these four filters were operated at rates of 500,000, 800,000, 1,500,000 and 2,500,000 gallons per acre daily at the time of a second experiment. Applying salt sewage as before, and collecting and determining the chlorine in samples from the outlets [illegible] as will be seen by an examination of the diagrams, that with these rates the applied and held sewage were about equally intermingled, and hence were about equal periods of time in passing through each filter. Through the shallow filter operating at a rate of 500,000 gallons per acre daily, 50 per cent of the salt sewage appeared in fifty minutes; through the 6-ft. filter, operating at a rate of 800,000 gallons per acre daily, 50 per cent appeared in fifty-five minutes; through the 8-ft. filter, operating at a rate of 1,500,000 gallons per acre daily, a little divergence was noted owing perhaps to slight clogging in this filter, as 50 per cent of the applied salt sewage was seventy-seven minutes in reaching the filter outlet, but through the 10-ft. filter, operating at a rate of 2,500,000 gallons per acre daily, 50 per cent of the salt sewage reached the filter outlet in 1 hour—that is, filter 455, 2½ times as deep as filter 452, and operated at a rate 5 times as great, gives equal time for sewage purification to occur as given by the shallow filter operating at one-fifth the rate, and hence equal purification. It is evident, moreover, from the diagrams that the rate of the deep filter could have been at least 3,000,000 gallons per acre daily.

These results show very clearly the reasons for the great economy of deep compared with shallow trickling filters. These filters are constructed of stone between ¾ in. and 1½ in. in diameter. Filters of larger or smaller stone allow differing times of passage and degree of intermingling; hence different but comparative results.

MUNICIPAL WORK IN COLOMBO.

ACTING WORKS ENGINEER'S REPORT.

There is much interesting reading in the annual report of the Municipality of Colombo for 1913-14, a copy of which has just come to hand. It appears from a statement of the chairman of the council, Mr. R. W. Byrde, that the period under review has been a momentous one. It has witnessed a series of misfortunes following one after another in quick succession. At the commencement of the period the city was visited by an outbreak of cholera, and then by disastrous floods. These were followed by the appearance in January, 1914, of plague, and later by an extremely severe attack of rinderpest and also of foot-and-mouth disease among the cattle. The financial position of the council has become more and more involved. The heavy drain upon its resources by the payment of the steadily increasing amount for interest and sinking fund charges on the drainage loan prevents the taking up of any new works, and seriously handicaps the maintenance of existing works. In 1914 His Excellency the Governor appointed a commission to inquire into and report on the affairs, financial and otherwise, of the Municipality of Colombo, and it is hoped that the commission may be able to devise some means of relieving the financial stringency.

One of the most important works to be carried out is the erection of a town hall capable of accommodating the whole of the municipal staff. This, states Mr. Byrde, is desirable from many points of view, but more especially in order to secure a greater degree of centralisation and control, which would conduce more towards efficiency and economy than is at present possible under the existing arrangements.

With regard to road improvements, apart from the question of new roads, it is considered to be most important that every opportunity should be taken to improve the existing roads by laying down granite setts, and by the provision of kerbs, channels, and gullies. The granite setts, by taking the heavy bullock-cart traffic, prolong the life of the road. The provision of kerbs, channels, and gullies is beneficial from a sanitary point of view, as they do away with the old-fashioned deep drains and make use of the new sewers.

Mr. Byrde proceeds: "Before improvements can be effected by town planning and housing schemes, it is essential that more effective legislation should be introduced and the law brought into line with that in other countries. The outbreak of plague called attention to the necessity of the introduction of such legislation. To meet the wants of the municipalities and local boards of the island, Government has drafted a Bill, which has been framed after a consideration of the law existing in Great Britain, India, and the principal Colonies. The important points involved are: (*a*)—(1) The securing of an adequate supply of light and air to every room used for human habitation; (2) the remedying of existing insanitary conditions; (3) the prevention of the creation of fresh insanitary areas. (*b*) The provision of (1) main thoroughfares capable of taking the traffic of the future; (2) intermediate streets opening up the intervening blocks of land so as to secure their development as building sites. There is plenty of land still available in Colombo for building purposes, but progress is retarded owing to the lack of frontage on streets and the present inaccessibility of the sites. The council requires to have a greater control over the opening up of land and the laying out and making up of private streets, so that private enterprise may be brought into accord with a clearly defined plan of general policy."

A flood in 1913 was the highest of which the municipality has a record. It inflicted great hardship on the inhabitants of the districts submerged, and also resulted in a heavy pecuniary loss to the council in the repair of the damages caused. It also imperilled the safety of the water supply to the city, one main being washed away and the other being in a very

critical position. The laying of the new 30-in. main, which is being carried out by Mr. W. M. Thyne, waterworks engineer, will prevent the water supply being again placed in such a serious predicament.

The Mansergh system of drainage has been steadily pushed forward. Some 106 miles of sewers have been laid. Mr. Ernest Mansergh paid a visit to Colombo in February, 1914, and was present at a meeting of council, at which he answered a series of questions with regard to the system. His scheme has been modified to bring it more into line with existing conditions and the recommendations of the city sanitation engineeer, Mr. Cox. Mr. Byrde remarks:

"It is to be regretted that private owners have not more readily adopted the new system and connected their houses with the sewers, but the introduction of water-carriage latrines and tipping depots enable a considerable use to be made of the sewers already laid. The adoption of a liquid disinfectant in place of coir has removed any objection which existed to the establishment of the tipping depots. The policy of the council should be directed to the erection of these depots in different parts of the city, as being one of the first steps towards the abolition of the Narahenpita depot. Mr. Cox has been engaged in a series of experiments at the Madampitiya treatment works, the result of which will have an important bearing upon the future policy to be adopted with regard to drainage of Colombo. They have also the merit of being the first of the kind conducted in the East, and accordingly have great scientific value."

ROADS.

In his report for the year Mr. Clive H. Kilmister, the acting works engineer, states that the total expenditure on all services was Rs.1,737,256·98, showing a yearly decrease of Rs.411,640·84 over the previous year, or 26·22 per cent decrease, compared with the previous increase of 38·9 per cent.

Mr. Kilmister observes that roads were maintained in a fair condition, but that there is still room for much improvement.

DUST PREVENTION.

Oil fuel, local gasworks tar, and Tarco have again been relied on and have given satisfaction.

Early in 1913 a private individual was, at the chairman's request, given some latitude to experiment upon a dust layer, which he alleged had been patented in foreign countries and had given satisfaction there. The damage done to certain road crusts during the fortnight of the experiment and the high rates did not warrant any extended use of this "specific," though it proved a dust layer for a short time. The average cost of oiling, tarring, and Tarcoing per square yard is 32 cents, 61 cents, and Rs.1·28 respectively

The following figures give the dust and mud collected: In 1912, 57,860 loads of dust and mud were collected. For the period of twelve months from July, 1913, to June, 1914, 30,916 loads were collected—*i.e.*, 26,944 loads less than in the 1912 period. This result is probably due to dust and mud preventive measures being employed.

"During my visit to Western Australia," says Mr. Kilmister, "the city engineer of Perth gave me information about a preparation called 'Kiton,' which has been one of the most successful dust palliatives employed in Australia. I obtained twenty-five sample barrels to experiment with in Colombo. The 'Kiton' has been laid near the Eye Hospital and is being carefully watched. So far it appears to be satisfactory, but I am not prepared to give a definite opinion until several months have elapsed. The method of application of the 'Kiton' and preparation of the road surface is quite unique, and requires skill and the careful attention of a responsible officer if the result is to be a success."

GRANITE SETT PAVING.

The benefits of the 3¼ miles of granite sett tracks now laid, says Mr. Kilmister, speak for themselvees, and more of these tracks are urgently needed. The merits of and reasons for the large extension of road paving of this kind have, he adds, again and again been urged, and it is impossible not to invite attention once again to them, and with the strongest possible emphasis.

SCAVENGING.

A very considerable decrease in the cost of scavenging is mentioned by Mr. Kilmister.

The reduction in the daily staff is due to organisation and redistribution of the labour. Formerly the labour was very scattered, and the overseers in charge could not exercise proper control or supervision over the work. With a view to facilitate inspection and ensure the punctual carrying out of the time tables, each ward has been divided up and a gang of coolies and carts apportioned to each section. The manner in which this arrangement has been carried out is shown in the printed time table of every ward. The number of coolies and carts distributed to each section is according to the area and population of the district to be served. The sections have been arranged so that the routes taken may form, as far as possible, complete circuits, in order that there may be no unnecessary movement of the scavenging staff.

Important and busy thoroughfares are treated wherever possible first, and each gang has to take a route, so that the carts may become full up when they have reached that portion of the section situated nearest to the refuse destructor or tipping depot.

An increase in the rates of pay was brought about by the recent outbreak of plague, when nearly all coolies abandoned work, and it was found necessary to offer them some inducement to return. Those coolies who were in receipt of 40 cents were raised to 50 cents, and those who previously received more than 40 cents were granted an increase of 5 cents per diem.

Although the average number of cartloads transported daily has been less than in 1912, the cost per load has been slightly reduced, which is due to better supervision and loading.

A table shows that, in spite of the decrease in the number of loads transported, the weight of rubbish incinerated at the refuse destructor has considerably increased.

This increase in the quantity of rubbish tipped at the destructor has been the chief cause of a decrease in the cost of incineration—now R.1·67—of 57 cents per ton.

It would appear that neither persuasion nor prosecution will make people take the trouble to keep their refuse in a receptacle ready for removal instead of throwing it on to the street or into the drains, and this is what increases the difficulty of the work. Some trouble is experienced in the removal of rubbish from the poorer class of property. Whole blocks of tenements either have no bins at all, or perhaps some small receptacle of insufficient capacity for the purpose for which it is required. The consequence is that large quantities of refuse are heaped up in places, such as private entrance passages to tenements, which municipal carts are expected to collect and remove.

Two self-tipping carts, twelve iron flushing carts, and twelve iron silt carts were constructed during 1914 and put into use. These are stated to be a considerable improvement on the contractors' decrepit wooden carts. The contractors' cart service is a source of never-ending worry and trouble, and is the principal cause of disorganisation and irregularities in the carrying out of the time table. The carters who are supplied with the carts are frequently changed, and are chiefly composed of beggars with little experience either of the work to be carried out or of the route to be taken. On occasions they bolt away and leave the carts on the streets to take care of themselves. The bulls which are supplied by the contractors, generally speaking, are of a very poor quality, and the majority are infected with some kind of disease.

Sometimes carts do not attend work for two or three days at a stretch, because the contractor has been unable to obtain carters, or the bulls have been seized by the S.P.C.A. inspectors.

During outbreak of cattle disease, such as rinderpest, great trouble is experienced in this respect; quite recently twenty bulls were arrested in one morning from three wards, and a steam tractor had to be hurriedly put on temporarily to take their place. All this goes to show the necessity for the council to provide its own transport.

In 1912 the rate of cart hire was raised from R.1·10 to R.1·50 per single-bullock cart, and from R.1·50 to Rs.2 per double-bullock cart, which was the chief cause of the tremendous increase in the cost of scavenging that year; but the increased price has not had the effect of improving the efficiency of the carters or the quality of the bulls in any way.

REFUSE DESTRUCTION.

The municipal destructor incinerates on an average over 50 tons of refuse a day, and is capable of consuming 60 tons. All the refuse in the city is now sent to it, with the exception of that of two wards which are too far away to be served.

USE OF TAR UPON HIGHWAYS.

ROAD BOARD CIRCULARS TO COUNTY, URBAN AND RURAL COUNCILS.

The necessity for avoiding the use of crude tar upon roads and footpaths is once more emphasised in circulars which were sent to county, urban and rural district councils last week by Mr. H. P. Maybury, M.INST.C.E., the manager and engineer to the Road Board. These are reproduced below:—

CIRCULAR TO COUNTY COUNCILS AND URBAN AUTHORITIES.

"I am directed by the Road Board to refer to their circular letter of March last, wherein local authorities were asked to use only refined or distilled tar in connection with their road maintenance and improvement works, in order that there might be no waste of those tar products required in the manufacture of explosives, and which are obtained by the distillation of crude tar.

"The board much appreciate the readiness manifested by highway authorities generally to comply with their request, and are satisfied that, as a result, a largely reduced quantity of crude tar has been used upon the roads in the past season, although they are advised that its use still continues in certain districts.

"This is no doubt partly due to the fact that the request was made at a time when road tarring operations had either commenced, or contracts had been entered into by which quantities of crude tar had been purchased, and partly to the fact that the importance of the request was insufficiently realised.

"The continually increasing demands for coal-tar products for the manufacture of explosives make it essential that no possible source of supply of the crude material shall be overlooked, and the board are again requested by the Ministry of Munitions to urge highway authorities to see that arrangements are now promptly made which shall absolutely prevent the use of crude tar upon highways and footways during the continuance of the war, whether for spraying, painting, grouting, or the manufacture of tarred macadam, taking care that, if the latter material be supplied by contractors, only refined tar shall be used in its preparation.

"The board are confident that when the great national importance of this matter is understood by highway authorities, they will gladly co-operate with the Ministry of Munitions, and will (by their instructions) ensure that all tar, or tar preparations, to be used in or upon road works shall have first been freed from the whole of the benzol, toluol, and phenol contents.

"The board will be glad if you will kindly furnish them with the information asked for on the attached sheet, so that the same may reach them not later than the 30th instant."

CIRCULAR TO RURAL DISTRICT COUNCILS.

"I am directed by the Road Board to inform you that they have again been requested by the Ministry of Munitions of War to communicate with all highway authorities, with a view to securing united action to prevent the use of crude tar upon roads and footpaths during the continuance of the war.

"The necessity for the recovery of the crude tar products, required in the manufacture of explosives, is so great and urgent that no effort should be spared in the endeavour to see that all tar used by highway authorities has been refined or distilled, by which means the benzol, toluol, and phenol compounds are made available for use by the Explosives Department of the Government.

"Refined tar can now be obtained in unlimited quantities, at reasonable prices, at so many gasworks and distilleries that the board are confident that, once the importance of the matter is realised by local authorities, they will gladly co-operate with the Government Departments, and issue such instructions as shall effectually prevent the use of all tar, and tar preparations, from which these valuable and essential products have not been extracted.

"As you doubtless know, the Road Board have issued specifications relating to tar to be used both for spraying, painting, and grouting, and the manufacture of tarred macadam, and if future purchases are effected in accordance therewith your authority will have the satisfaction of knowing that they are carrying out their road-tarring operations with material best suited for the purpose, and will, at the same time, have succeeded in conserving for national purposes the products which are now so urgently required.

"Further, I am directed to send you the attached list of questions, and to express the hope that your council will furnish the information required, so as to reach the board not later than the 30th instant."

The questions referred to ask for a statement of the quantity of refined and crude tar used by either direct labour or contract for surface dressing (spraying, painting) between April 1st and September 30th last, and the area covered; also the quantity of tar and proprietary material employed for material coated or grouted during the year 1915-16.

CORRESPONDENCE.

Ex uno disce omnes.
(*One man does not see everything.*)
— EURIPIDES.

MILITARY ROAD TERMS.

To the Editor of THE SURVEYOR.

SIR,—In your issue of the 19th inst. your contributor of "Things One Would Like to Know" gave some illustrations of military road terms, upon the meaning of which he desired information.

So far as I can gather the meaning of these words are as follows:—

(1) "Salient angles" probably refers to the outside apex of the angles of a road which has a sharp curve in it.

(2) "An Irish bridge" is not a bridge at all, but is a paved channel running diagonally across the surface of a road to carry the rain water from the gutter on one side to the gutter on the other side of the road.

(3) "French drain" is a trench filled up with large stones so as to act as a drain.

(4) "Gabions" are large wicker baskets without top or bottom filled with stones or gravel, sometimes used as drains by being sunk just below the surface.

(5) "A humped road" is a rather clumsy description of a barrelled road, or a road with a camber.

(6) "Spitlock lines." These are apparently shallow depressions cut into the surface of a steep road in order to give better foothold.

(7) "Soling" is the bottoming or strength coat of a carriageway.

(8) "Berms" are the verges, or unmetalled pieces left at the sides of roads. The word is used in fortification work, and is derived from the French word *berme*, a border. It is curious to note that, with very few exceptions, nearly all military terms are derived from the French.—Yours, &c.,

MILITARIUM.

Westminster, S.W.
November 22, 1915.

THE SUPERINTENDENCE OF HOUSE CONNECTIONS.

To the Editor of THE SURVEYOR.

SIR,—Allow me to thank Mr. Robert S. Scott for his letter in reply to my query *re* the above.

It is concrete evidence of this nature that I require in support of my case, and if other surveyors who occupy positions similar to that described in my query would be good enough to give their experiences, either in your columns or to me personally through your office I would feel very grateful to them.

In reply to the latter portion of your correspondent's letter, the dispute in question refers only to drains of houses already occupied, and not to new buildings, for the supervision of which I am responsible from the passing of the plans to the issuing of the final certificate of approval.—Yours, &c.,

T.

November 23, 1915.

County Down Assistant Surveyors.—The Down County Council have decided to reduce the number of assistant surveyors to six, instead of twelve, with a salary commencing at £200 a year, with annual increments of £5, rising to £250, with 2d. per mile travelling expenses. It is proposed to offer the positions to the assistants in the order of seniority. Those whose offices are to be abolished are to be compensated. The officials concerned strongly object to the proposals, which they consider are of a most drastic nature, and they have appealed for protection to the Local Government Board.

Bognor Housing Schemes.

By OSWALD A. BRIDGES, M.R.SAN.I., LIC.R.I.B.A., &c., Engineer and Surveyor to the Urban District Council.

Before the war broke out numerous local authorities throughout the country were considering schemes for the erection of workmen's dwellings which could be erected at a reasonable figure and let at about 5s. per week. Some authorities had commenced building operations, and others had only just secured the land. To prove what extensive schemes some councils had in contemplation, I will mention that of the city of Lincoln, where 60 acres had been purchased solely for the erection of workmen's dwellings. This scheme would by now have been well advanced had it not been for the war.

At Bognor the housing question was first thought of seventeen years ago, when the urban council purchased sites in Ockley-road for six cottages, but only built two, which cost £230 each without the land. In 1912 the matter was under consideration again, and land in Sheepwash-lane and Gravits-lane—a very healthy locality on the outskirts of the district, and yet within easy reach of the town—was purchased for £5 10s. per site of 15 ft. frontage, and 100 ft. in depth. The aspect is south-west, and the ground is in a charming, well-wooded district; from the backs of the houses a fine view of the South Downs is obtainable, and in front lies the village of Aldwick, which is on the coast line. In Sheepwash-lane the council erected thirteen cottages by contract, at a cost of £2,700. These are let at 5s. 6d. per week, and contain sitting-room, kitchen, scullery, wash-house, coals, pantry, and water-closet on the ground floor, and three bedrooms on the first floor.

So well were these houses taken up—almost before they were ready—that my council decided to build others in Gravits-lane, to let at 4s. 6d. per week each, and to contain living room, scullery, pantry, coals, and water-closet on the ground floor, and three bedrooms on the first floor. Tenders were invited for a block of twelve cottages, but the lowest tender was £179 2s., or £29 2s. above the amount granted by the Local Government Board. This was considered excessive, and the work was ultimately done departmentally, which was evidently the correct course to adopt, for the cottages were built for under £150 each, after paying all expenses, such as the clerk of works, wages, and the cost of loan. The council then proceeded to erect two more blocks, of eight in each block, in Gravits-lane, by direct labour; but, owing to difficulties met with on the site, in strengthening the foundations, and the rise in the price of materials and labour, owing to the war, the cost of these cottages went up to £160 per house, for which an excess loan was granted by the Local Government Board.

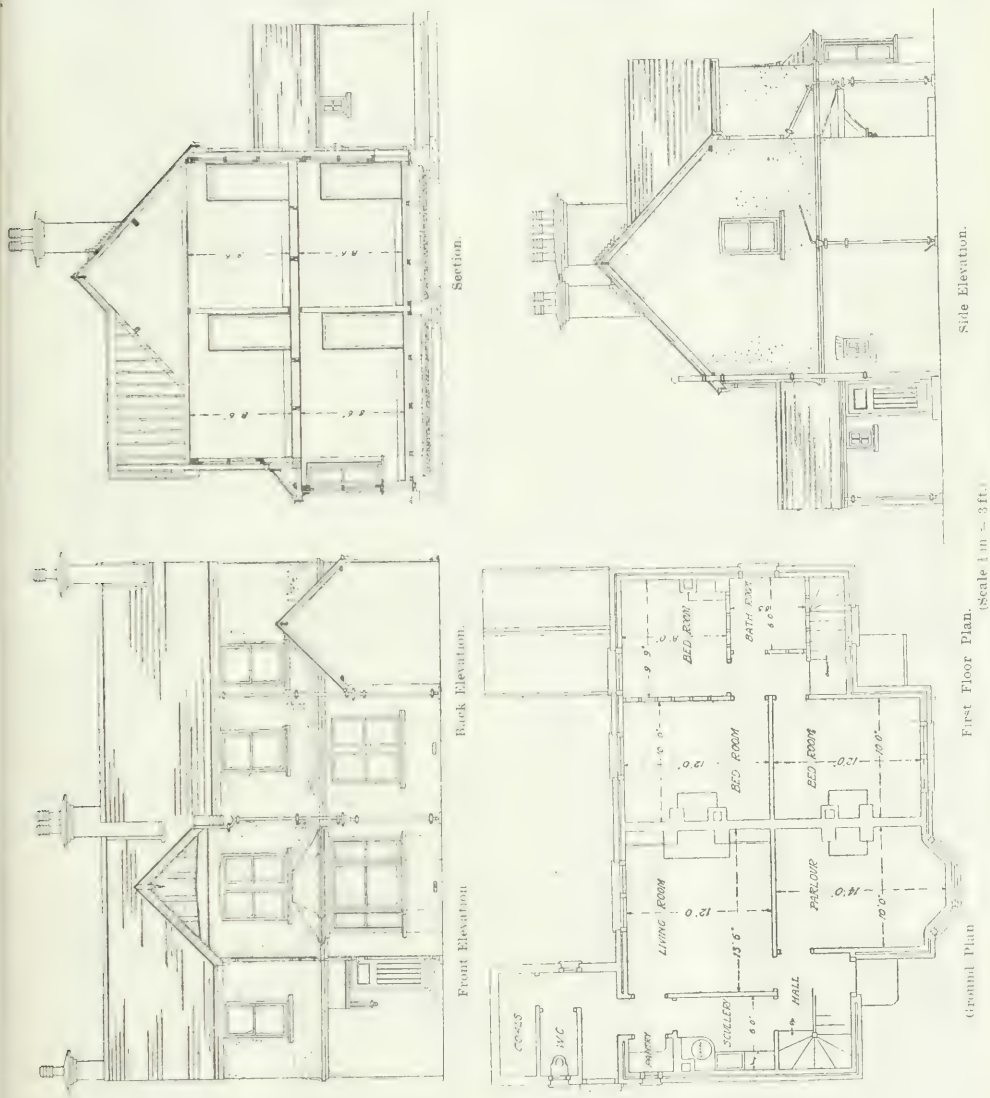
Bognor Workmen's Dwellings.

(Cottages in top view are let at 4s. 6d., and those in bottom view at 5s. 6d. per week.)

Although the council purchased the entire frontage in Sheepwash-lane and Gravit-lane on this piece of land, which made sixty-four sites, only forty-one cottages have been erected, the remainder of the land being left for the time being until the district is more developed. A valuable site was then purchased in Linden-avenue, this having 1,000 ft. of frontage, with an average depth of 90 ft. in a road that is sewered, kerbed, channelled, and partly made up. The cost was 25s. per foot frontage. This land is connected to Sheepwash-lane and Victoria-drive, and is nearer the heart of the town. It is an ideal position, and a better class of dwelling was to have been erected, the houses being estimated to cost £250, and to let at 7s. 6d. per week. They contain living-room, kitchen, scullery, pantry, coals, and water-closet on the ground floor, and three bedrooms and bath-room on the first floor.

The council had obtained sanction to build four of these houses, which were to be semi-detached, when the war stopped operations. This was the cause of another housing scheme being placed aside for a time. The council had agreed to purchase a field in Sheepwash-lane, containing 5½ acres, upon which were to have been erected 107 cottages, to let at 4s. 6d. The estate was to have been laid out on garden city lines, with an island garden in the centre of the road, on which was to have been erected a rustic octagonal summer-house, or shelter with red-tiled roof, and the grounds laid out and planted. The plans and schemes had been before the Local Government Board and the inquiry held, and everything was in readiness to commence, the sanction for the loan only being awaited.

As all these estates are situated in a district which was but thinly populated, and the surroundings being quite of a rural character, the buildings have been so designed as to be made pleasing in appearance, and to harmonise with the localities. The houses are all built with 11-in. cuts de hollow walls



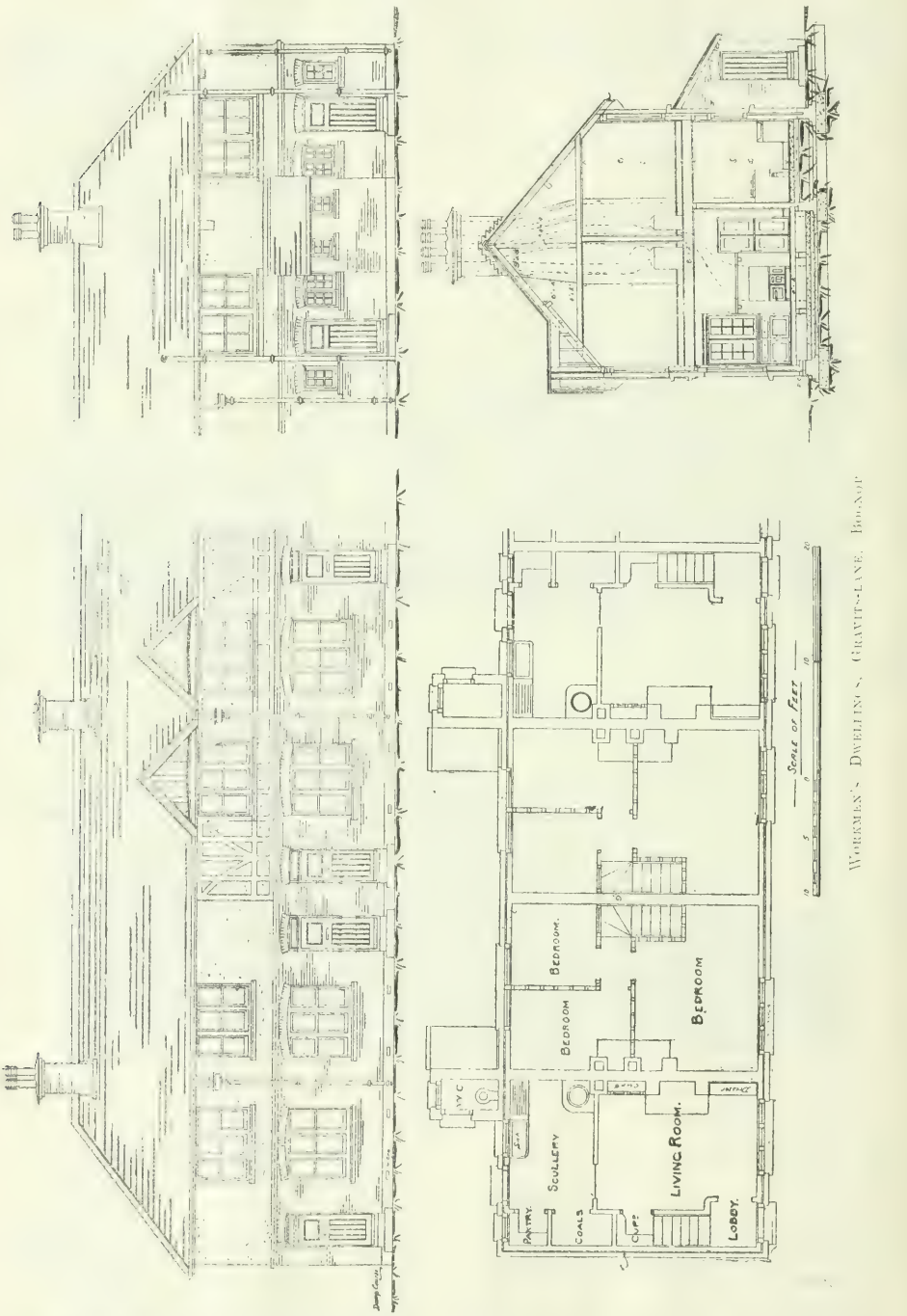
PROPOSED ARTISANS' DWELLINGS, LINDEN-AVENUE, BOGNOR.

which is a necessity in the neighbourhood; but even with hollow walls care must be taken to keep the wall-ties free from deposit of mortar, otherwise damp will be drawn into the house, where these ties occur. A good way to prevent this from taking place is to use a 1½-in. batten, leaving it on the ties to catch all deposits of mortar, until the next course of ties has to be built in, when it can be easily drawn up the cavity, and the mortar removed.

Local clamp bricks were used in the building of all cottages, except for the chimneys and the lower portion of the buildings, from the ground to the first-floor level, where South Water red-face bricks were used. The latter are a very good weather-resisting

brick. The joists were pointed in cement, and the portion above was cement-rendered and pebble-dashed. Imitation half-timbered work in cement, with lime dash panels, was introduced at intervals to give relief to the front of the house. "Rose-

cap; when the felt is all on, laths (ordinary sawn plasterers' laths) should be nailed on the felt vertically, 12 in. apart. The tile battens can then be nailed on, and, as they do not touch the felt, any water that gets through the tiles will have a free



Workmen's Dwellings, Gravit-lane, Bucknor

ends leading to the lawberry tiles were used to complete the roof, which were bearded and oiled. Care should be taken in putting on the felt. It should be commenced at the foot of the rafters, and each length laid horizontally with a 3-in

passage to the gutter, and in this way no leaks will occur inside the cottages.

All chimneys have dampcourses inserted as they rise out of the roof. These can be formed of cement or slates, and have sunk gutters and lead

flashing. I am of opinion that lead should be used everywhere where necessary, as it will save a lot of trouble in the future.

The flues have had special attention, and so far I have not received a single complaint as to smoky chimneys. Nothing is worse than to have to live in [illegible] smoke constantly being emitted from the fireplace. To prevent this I have constructed all the flues and carried the chimneys well above the roof, and fixed 30-in. louvred chimney-pots on [illegible] I have always found efficacious. The floors are laid with rebated floor-[illegible] which excludes all draught on the ground floor, and in the case of the first floor prevents dust and germs finding their way in between the joists. But, above all, the ceilings below are never discoloured through a person washing the floor above, as the water cannot get through the rebated joint of the flooring.

Picture rails are used, which cost but very little; I [illegible] 6s. 6d. per 100 ft., and will pay for themselves over and over again by preventing the walls being knocked about by nails being driven in indiscriminately. The kitchen dresser has been made a feature in each cottage, and has the appearance of quite a nice piece of furniture. It has a double cupboard fitted with shelves, with two drawers above, and the top portion fitted with 1½-in. sashes to keep the dust from the crockeryware. Another [illegible] is fitted on the other side of the [illegible] to the copper.

The window frames and sashes have all been made to detail, and every precaution taken to make them weather-proof. The inside doors were 1½ in. in thickness, moulded both sides in the solid—*i.e.*, the moulding was worked on the stiles and rails—and the panels were of three-ply wood, which will prevent cracks in the panels occurring. The front and back doors had 4-in. by 3-in. rebated and moulded deal frames, with oak cills, to which were hung 2-in. framed and braced doors, with a large glazed panel in each case in the upper portion to let in light. The doors to coals and water-closet had similar frames, but only ledged and traced doors.

The cupboards were formed with 1¼-in. square and flat pannelled doors, and beaded frames, with 1¼-in. tops. All shelves were of 1½-in. material, fixed to strong bearers. The window boards were 1¼-in. and rounded. The door and window linings were of the same thickness material. The stairs were formed with 1¼-in. strings, 1-in. risers, and 1¼-in. treads, with bed mould under. Deal handrails were provided on one side of the stairs, supported on wrought-iron brackets, let 4 in. into the wall; 2-in. deal mantel-shelves were provided and fixed upon wood supports, let into the brickwork over the kitchen fireplaces. The plastering was all done with "Seraphite," which gives a very smooth surface and takes very well the washable distemper with which the walls are coloured.

The window cills, hearths and steps were all formed in cement. The walls of sculleries, water-closets, pantries, coals, copper, and cupboards were cement-rendered to ensure durability. The floors of water-closets, pantries, cupboards, sculleries, coals, and yard (for a distance of 10 ft., extending the whole width of the cottage) were formed with 4 in. of cement-concrete, laid upon 6 in. of brick rubbish and trowelled smooth. In the case of the yard paving, it was laid with a fall to the nearest gully, so as to take quickly away any water falling upon such area. The whole of the site (under the floors) was similarly treated, but the concrete was not trowelled, being simply brought up to a good surface by the use of a shovel. The sizes of scantlings were as follows—viz., plates, 4 in. by 3 in.; ground joist, 4 in. by 2 in.; first-floor joists, 8 in. by 2 in.; [illegible] 4 in. by 2 in.; rafters, 4 in. by 2 in.; purlins, 6 in. by 3 in.; ridge, 9 in. by 1½ in.; lintels, 4 in. by 3 in.; long lintels, 6 in. by 4 in.; barges, 9 in. by 1¼ in.; and facia boards, 1 in. Portable ranges, fitted with cast-iron backs and sides, and cast-iron smoke pipes were also used in the kitchen, and a tiled mantel register in living-rooms (these were only fixed in the 5s. 6d. houses); smaller stoves of a similar type, without tiles, were fixed in the bedrooms.

Ventilators were fixed in bedrooms without fireplaces. The gutters were 4½ in. half round, with 3-in. down-water pipes. Medium weight London County Council pattern ventilating pipes were used for the drainage system, with caulked lead joints, and fitted with galvanised wire globes. The locks were all rim-locks, which were specially selected and had Mace's brass furniture fitted to them to prevent the knobs continually coming off, as is the case with ordinary brass furniture; 21-oz. English sheet-glass was used for all windows, except those which were obscured, where white Japanese was adopted. The whole of the internal woodwork is finished with Matsine, coated with good varnish, which is inexpensive and will last for years. The drains are so laid that each system of a block of buildings can be efficiently flushed by the discharge of water from a water cart.

Six-inch stoneware socketed pipes were used for all main drains, and 4-in. ditto for all connections, the joints of which were formed in cement, and tested with water before being finally filled in. The manholes were constructed in cement with local clamp bricks, and were all rendered in cement; each house had such a chamber, in which there was fixed an interceptor and fresh-air inlet. The manholes were double-sealed, of medium weight.

The water-closets were of the "wash down" pedestal type, with white wood seat, and fitted with 3-gallon flushing cisterns to keep the drains free. The sinks were of white glazed inside and cane out, and fitted with a 1¼-in. lead waste pipe and "S" trap, discharging over a trapped gully outside the cottage. All rain-water pipes discharged over gullies.

Each house had a galvanised-iron dustbin with cover, to hold 6 cub. ft.

The fencing in front of cottages was of the "open pale" type, 3 ft. in height, 2½ in. by ¾-in. deal pales, 1¾ in. apart, securely nailed by 2-in. galvanised nails to 3-in. by 3-in. deal arris rails, attached to 6-in. by 4-in. larch posts. The back fences were very similar, but were close-boarded, and 6 ft. in height. The whole were tarred before and after fixing.

Each house was laid with gas and water pipes; in the case of the gas pipes the local gas company put in the pipes free of cost, and supplied the gas stove and the penny-in-the-slot meter. The question of providing baths in each house was considered, but after making inquiries from other authorities these were left out, and the Local Government Board did not insist upon their provision. Where the work was done departmentally, all materials that were required were advertised for, and the lowest quotations accepted, except in one or two cases where the samples did not come up to the requirements.

Local clamp bricks are obtainable in this district very cheaply—viz., 25s. per 1,000, carted on to the works. The facing bricks cost 47s. 6d. per 1,000 at the station. Pit sand cost about 6s. per ton on the job. Bricklayers' wages are 7½d. per hour, plasterers' 8d., carpenters' 7½d., painters' 7d., and labourers' 5½d. A clerk of works was in charge of the work, and was responsible for everything from the time the men started until they left off. The money for land and buildings was borrowed from the Public Works Loan Board at 3½ per cent, the land loan to be repayable in eighty, and that for the houses in sixty years. For repairs, &c., we allow 12½ per cent, and make a profit of £1 per house per annum. The rents are collected every Monday morning, without fail.

[The accompanying photographic views of the dwellings erected at Bognor by the author of the foregoing article appeared in our pages on October 1st last. Ed.]

Municipal Expenditure in Scotland.—The Secretary for Scotland was asked in the House of Commons on the 11th inst. whether a circular was issued in August by the Local Government Board of Scotland advising local authorities to curtail expenditure on parks, recreation grounds, libraries, street lighting, and other objects, with the object of reducing local rates in view of the increased Imperial taxation due to the war; if so, would he say how many local authorities responded to that circular by reduction of their rates; and would he give the names of the local authorities, if any, that had increased their local rates, notwithstanding the appeal of his department. Mr. McKinnon Wood stated that, following an earlier circular dealing with another aspect of the same subject, the circular referred to was issued in August to some 2,000 local authorities throughout Scotland rating for all kinds of local purposes, including those specified by his hon. friend. He could not give a detailed reply on the points suggested without the issue of a further circular asking for specific information, and he did not think the time for such action had yet arrived. They must give a little time. They could not tell in the following week whether the circular had been effective in reducing the rates.

Law Notes.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—*i.e.*, without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter X, combinations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.*

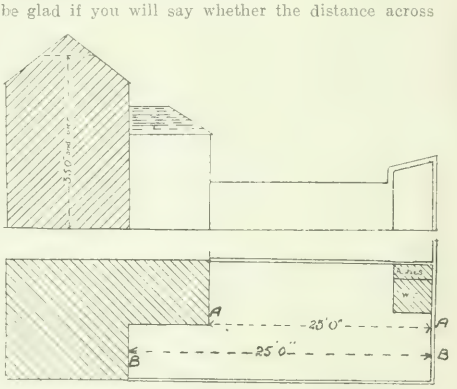
Highways: Taking Materials for Repair.—"Stencil" writes: (1) A very considerable divergence of opinion appears to exist in my district regarding the right of Road Trustees to take materials under sec. 80, Schedule C, Roads and Bridges (Scotland) Act, 1878, and in particular with regard to the interpretation of the phrase, "where materials have previously been in use to be taken," which I take it applies only to "enclosed land." In one case I have what I consider undisputable evidence that a certain quarry in "enclosed land"—pasture—has been worked more or less regularly by the Road Trustees for upwards of forty years, men being still alive who worked in the quarry, while others can testify to seeing the quarry worked for the Road Trustees forty to fifty years ago. The proprietor of the ground has asked me to produce my "authority" for taking metal from this quarry. I have replied that my authority is the above-mentioned sec. 80, and that the quarry is a place "where materials have been previously in use to be taken," and that I am not aware that any further authority is required. The proprietor states that I must produce an "authority" granted by the estate for the opening of the quarry, but my contention is that the quarry, having been in use when I took up duty here in 1904, and for many years prior to that date, no such authority is required. See *Graham* v. *Road Trustees of Renfrewshire*, 1851. Irrespective of the prescriptive right which, in my opinion, forty years' occupation of the quarry would give, I shall be much obliged to have your opinion on the facts stated, as also in the case of a quarry which had been worked for, say, ten years previous to this date. (2) What powers have Road Trustees to take gravel or boulders from river beds and from the foreshores, where the approaches thereto are fenced and unfenced? (3) Who is responsible for the damage caused by undermining of roads and retaining walls by rabbits? Whose property are the rabbits? Have the Road Trustees the right to kill and dispose of the rabbits? The roads where the damage has taken place are both fenced and unfenced.

(1) The case referred to (*Graham* v. *Renfrewshire Road Trustees*, 1851, 13 Sc. Sess. Cases, 2nd Series) appears to support the contention of the querist. It was there held that, in order to be freed from the necessity of giving the notice required by sec. 80 in the case of inclosed land, it is sufficient for the trustees to prove that there has been previous use within the meaning of the section with the knowledge and sanction of the occupier, and without hindrance from the proprietor of the ground. As Lord Cockburn said, "The statute proceeds on the fact of legal use, but that fact may take place without a written notice," and presumably also without a written authority. (2) In the case of tidal navigable rivers, both bed and foreshore are by law vested *primâ facie* in the Crown. In the case of non-tidal, whether navigable or not, the bed and banks are the property of the riparian owners (see Green's Encyclopædia of Scots Law, Tit. "River"). We are aware of no direct statutory power to road trustees to take gravel or boulders from bed or foreshore in either case. A very limited knowledge of Scotch law leads us to refrain from offering any more definite opinion on this question. (3) See the latter part of our answer to (2).

Deposit of Plans: Obstruction to Highway.—"Bon-acord" writes: I forward copy of building by-laws in force in this district, and shall be glad if you will advise me on the following points: (1) By-law 88, relating to the deposit of plans for new building, provides: "Every person who shall intend to erect a building . . . shall cause to be deposited plans . . . in which the building shall be so described as to show whether it is intended to be used as a dwelling-house or otherwise." In the above circumstances, I contend that, whatever building any person may intend to erect, he must submit plans of it. Am I right? Part II. of the Public Health Acts Amendment Act, secs. 22-25, has been adopted by my council. I rely on sec. 23 in my contention, as well as our by-laws. In the case in point a person has erected a large shed in his back yard. One end abuts on the adjoining property boundary, and one side joins another building in the same curtilage. (2) A 9-ft. wide field-gate abutting on a district road, and 3 ft. 9 in. high, is the entrance to an acknowledged footpath, but the owner keeps this gate entrance chained and locked. My contention is that, owing to the said gateway being locked, it is an obstruction within the meaning of the Highways Act. Am I right?

(1) By-law 88 requires that "every person who shall intend to erect a *building*" shall deposit plans, &c., but inasmuch as by-laws as to structure can only be made *qua* "*new buildings*," it may be assumed that for the purposes of this query the word "building" in by-law 88 is equivalent to "new building," and the by-law requires the deposit of plans, &c., in the case of every "new building." As to the meaning of "new building," see the reply to "Venus" in our issue of October 15th last. (2) An obstruction on a highway may be lawful if the highway was dedicated subject to it, and it is strong evidence that this was so if the obstruction has existed in its present condition as far back as living memory goes. Any obstruction erected subsequent to dedication is unlawful.

By-laws: Rear Space.—"R. W." writes: I shall be glad if you will say whether the distance across



the rear space of a dwelling-house should be measured between points A A on sketch or points B—B.

Although the height of the main building determines the distance across the open space, we think that the distance should be measured from the rearmost wall, whether of a back addition or otherwise. Thus, in the case shown on the sketch, it should be measured between the points A A.

Recruit for Wages: Necessity for Stamp.—"Puzzled" writes: I should be glad to hear your opinion of the following: Certain council employees have in the past been in receipt of a weekly wage, which has on occasion, with overtime, reached above £2, and for which the auditor has demanded a stamped receipt. The men are now paid by the hour, and as the weekly payments are a series of hourly payments, will you please inform me if a stamped receipt is still necessary for a sum exceeding £2? I might add that I have taken part in the payment of wages in another part of the country, but a stamped receipt was never demanded in such circumstances.

The Stamp Act, 1891, imposes a duty of one penny upon every "receipt given for, or upon the payment of, money amounting to £2 or upwards," while by section 103 a penalty is provided if any person, "upon a payment to the amount of £2 or upwards . . . separates or divides the amount paid with intent to evade the duty." In our opinion the liability to pay the duty depends upon the amount of the payment, and if a receipt is given for wages amounting to over £2, paid at the end of a week, it should be stamped, even though the workman is paid by the hour. No particular form of words is necessary to constitute a receipt, and even if the receipt is merely by means of a signature on a wages sheet it should be stamped.

Emptying Cesspools: Negligence: Liability of Council.—"Kerker" writes: My council empty a cesspool to four cottages by means of tumbler carts. The sewage is first pumped into the carts and then syphoned into a manhole about ¼ mile distant; but in performing this operation the men have allowed a certain amount of the sewage (which is very weak) to run on the road, and, getting to a surface-water

The Surveyor
And Municipal and County Engineer.

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stream. It has found its way into a pond some 200 yds. off. The tenant of the field in which the pond is situate has lost two horses through poisoning, and alleges that this pollution of the pond has caused their deaths. He is claiming damages. Will you kindly say whether there is any liability on the part of my council? The drain has been in existence a number of years.

If the defendant can prove that the horses were poisoned owing to the presence of sewage in the pond, we think the council are liable. It is assumed that the council empty the cesspool in pursuance of their powers under sec. 42 of the Public Health Act, 1875. This being so, they are bound to exercise due care and skill in the execution of the work, and if it is done negligently they are liable for any damage or injury caused thereby. If, on the other hand, negligence cannot be proved, the council are liable to pay compensation under sec. 308, which provides that "where any person sustains any damage by reason of the exercise of any of the powers of this Act, in relation to any matter as to which he is not himself in default, full compensation shall be made to such person by the local authority exercising such powers. . . ."

Motor Lorries for Municipal Work.—Shoreditch Borough Council are considering the advisability of purchasing motor lorries, as they are unable to purchase horses under £110 each.

Sewage Disposal at Sheffield.—No detailed report in regard to the disposal of the Sheffield sewage will be presented this year, under the special circumstances, but the statistics have been prepared, and will be at the disposal of the members of the committee if required. The treatment, states Mr. Charles F. Wike, M.INST.C.E., the city engineer, in his annual report, has proceeded as usual. The total volume of sewage treated amounted to 7,686 million gallons, or an average of just over 21,000,000 gallons per day, and 64,143 tons of sludge have been removed. In the previous year 7,197 million gallons of sewage and 62,129 tons of sludge, respectively, were similarly dealt with.

Belgium Town Planning Committee.—This body, whose work was highly praised in the preamble to the recent Town Planning Law decreed by the Belgian Government, have arranged a new series of lectures for Belgian architects and engineers, taking place at University College, London, on Thursdays in each week. British members of professional bodies, especially those having a knowledge of French, will be welcomed at these and subsequent gatherings. Among those who are giving their services are Colonel R. E. Crompton (consulting engineer to the Road Board), Mr. G. Midgley Taylor, Mr. George L. Pepler, Mr. W. R. Davidge, Mr. Raymond Unwin (chief town planning adviser to the Local Government Board), Mr. Aneurin Williams, M.P., Prof. Patrick Abercrombie, and Prof. S. D. Adshead.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not rather interesting to note in the annual report of Mr. Charles F. Wike, the city engineer of Sheffield, for the year ended March 25, 1915, which has just been issued, that the works which were "not commenced on account of the war" would have cost upwards of £85,000? Would it not be very interesting to know what saving has been effected throughout the country by municipalities who have stayed their hands in expenditure which was not absolutely necessary?

* * * *

Has not the new method recently adopted of passing an electric light, by means of rods, along the inside of a drain, in order to examine it, much to recommend it? Is not the credit of this useful innovation due to the ingenuity of Mr. W. Matthew Jones, the city surveyor of Chester, and is he not to be congratulated upon having thought of this method of inspection?

* * * *

Were not those who attended the annual meeting of the Institution of Electrical Engineers well rewarded by listening to the admirable address of Mr. Charles Sparks, the president, and by the presentation to the institution of a large number of books and relics of Michael Faraday, the investigator and discoverer of magnetic electricity? Was it not rather to be regretted that a whole evening had not been devoted to a Faraday meeting, as the explanation of the relics and the remarks accompanying the presentation were of almost historical interest?

* * * *

Is not the scheme of the Automobile Association and Motor Union, of Farnum House, Whitcomb-street, W.C., by which military car drivers discharged from the Army through wounds or illness may be enabled to re-enter civil employment a good one? Should not this be encouraged in every way, and everyone who is in want of a chauffeur write to the secretary at the above address? Are there not still a large number of young and able-bodied chauffeurs to be seen driving cars in London and elsewhere who one would have thought could be spared to take their part in the defence of their country?

* * * *

Is not Mr. A. E. Collins, the well-known city engineer of Norwich, to be congratulated on his article on "Heavily Loaded Wheels on Highways" in this month's *Journal*, in which he treats the subject in a thoroughly scientific and at the same time practical manner? Does not his scheme for a sort of sideways rocking movement of the wheels get over many of the difficulties as regards tyres not conforming to the contour surface of a road, and shall we not all agree with his remark that his desire is not to oppress the heavy motor industry, but so to adjust matters as to effect the utmost combined economy and to enable advantage to be taken of improvements and extended knowledge?

* * * *

Is it not to be hoped that the special meeting of the Institution of Civil Engineers convened for Tuesday next in order to alter the by-laws and to obviate the necessity of pressing for the subscriptions of members who are serving their country at the Front, will be well supported, and the necessary resolutions carried? Is it not also satisfactory to see that some latitude is even proposed in the case of those engineers whose incomes have been hard hit by the war?

* * * *

Who is Mr. Massac Buist, who writes an article in last Sunday's *Observer* on "Roads in the Motor Era," and who has just awakened to the fact "that the roads are carrying a great deal more traffic of all sorts than they have ever done before, and are to that extent justifying more fully than ever before the policy of building and maintaining them"? Is this not a remarkable discovery, and is not his deduction that "of course, the roads will be worn out more quickly under such increased traffic conditions" still more important? Is it not a pity that these learned conclusions have not hitherto come to the notice of road surveyors?

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

511. Tramway Construction.—Discuss spiralisation in tramway construction. (J. D., *West Hartlepool.*)

514. Water Supply.—A storage reservoir and a service reservoir are situated at a distance of 5 miles apart, and are connected by a 12-in. main, which, at a point 1 mile from the service reservoir, feeds a 10-in. distributing main. The top-water levels of the storage and service reservoirs are 850 and 750 ft. respectively above ordnance datum, and the level at which the distributing main leaves the trunk main is 400 ft. above ordnance datum. When water is passing into the distributing main at the rate of 60,000 gallons per hour, what will be the (1) pressure in the trunk main at the connection with the distributing main? (2) the quantity of water passing from each reservoir towards that point? and (3) the hydraulic gradients from the reservoirs to the junction of the trunk and distributing mains? ("Ionic.")

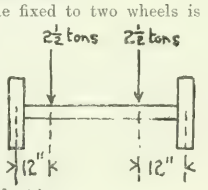
515. Sewage Effluent.—Litmur paper is sometimes used in trying the quality of a sewage effluent. State how this is done, and also how to determine roughly the quality and purity of a sewage effluent by this means. ("Student.")

516. Beams.—Show how to determine the bending moment and shearing force at any point of a beam which is continuous over three supports and carries a uniformly distributed load.

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

510. Axle Stress.—An axle fixed to two wheels is driven at the centre by a chain, and supports two bearings, distant 12 in. from the centre of the wheels, the load on each bearing being $2\frac{1}{2}$ tons. If the power exerted is 20 h.p., and the rate of turning is 30 revs. per minute, find the maximum intensity of stress in the axle if its diameter is 5 in. (Student.)



This axle is under the combined action of bending and torsion and the stresses induced are: (1) Shear stress due to torsion in planes perpendicular to the planes through the principal axis; (2) Tensile and compressive bending stresses parallel to the principal axis; (3) Shear stresses resulting from the bending forces, and for shafts which are not VERY short, these need not be taken into account. Considering (1)—Let Fig. 1 represent a cross-section of the axle.

The total shearing force on an elementary ring of radius r and width $dr = 2\pi r dr \times q$ where q = intensity of shear stress at distance r. But the stress is proportional to its distance from the axis

$$\therefore \frac{r}{R} = \frac{q}{f_s} \text{ where } f_s = \text{intensity of stress at surface of axle}$$

$$\therefore q = \frac{r f_s}{R}$$

hence $q \times 2\pi r dr = \dfrac{f_s \times 2\pi r^2 dr}{R}$ and its moment round the axis is

$$\delta T = \frac{2\pi f_s r^3 dr}{R}$$

Dividing the whole section into elementary concentric rings and summing the moments, the total torque or twisting moment

$$T = \frac{2\pi f_s}{R} \int_0^r r^3 dr = \frac{\pi}{2} f_s R^3 = \frac{\pi}{16} f_s d^3$$

$$\therefore f_s = \frac{16\,T}{\pi d^3} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Considering (2)—Let f = the value of the extreme equal and opposite intensities of longitudinal bending stresses occurring at opposite ends of a diameter of a section,

$$f = \frac{M}{Z} \quad \begin{matrix}\text{where M = bending moment at the section} \\ \text{and Z = section modulus}\end{matrix}$$

now $Z = \dfrac{\pi d^3}{32}$ for a round shaft of diameter d

$$\therefore f = \frac{M}{\frac{\pi}{32} d^3} = \frac{32\,M}{\pi d^3} \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

The following formula gives the maximum value of the intensities of the principal stresses for combined bending and twisting—viz., $f_1 = \frac{1}{2} f + \sqrt{\frac{1}{4} f^2 + f_s^2}$ . . . . (3)

(For proof of this see Morley's "Strength of Materials," page 22), this being tensile on the skin which has maximum

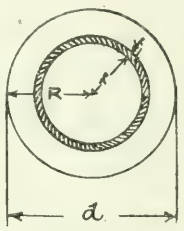


FIG. 1.

tensile bending stress and compressive diametrically opposite.

Substituting the values found in (1) and (2) in (3), we have

$$f_1 = \frac{16\,M}{\pi d^3} + \sqrt{\frac{\frac{1}{4}(32)^2 M^2}{\pi^2 d^6} + \frac{(16)^2 T^2}{\pi^2 d^6}}$$

$$= \frac{16}{\pi d^3} (M + \sqrt{M^2 + T^2}) \quad . \quad . \quad . \quad . \quad (4)$$

In the case under consideration the maximum bending moment cannot be found, as the distance between the wheels is not given; however, the bending moment M at the sections under the bearings = 2240 × 2½ × 12 = 67200 inch-lb. The axle in transmitting 20 h.p. at 30 revolutions per minute, the torque or twisting moment

$$T = \frac{12 \times 33000 \times 20}{2\pi \times 30} = 42016{\cdot}8 \text{ inch-lb.}$$

This is the mean value of the torque, and the maximum value of this will generally be considerably greater than this amount, by an amount which varies with the nature of the driving or gearing, and will not be taken into consideration here.

Substituting these values of M and T in (4), we have

$$f_1 = \frac{16}{\pi d^3} \left(67200 + \sqrt{(67200)^2 + (42017)^2}\right)$$

$$= \frac{16}{\pi d^3} (67200 + 69055) \text{ and taking } d = 5 \text{ inches}$$

$$= \frac{16 \times 136255}{3{\cdot}1416 \times (5)^3}$$

$$= 5551 \text{ lb. per sq. inch}$$

∴ the maximum intensity of stress = 5550 lb. per sq. inch.

(J. G. W., *Downpatrick.*)

512. Hydraulic Gradient. A horizontal main consists of 5,000 ft. of 6-in., 5,000 ft. of 9-in., and 5,000 ft. of 12-in. diameter. The velocity in the 6-in. is 12 ft. per second, and the pressure head 50 ft. at the inlet. Sketch the hydraulic gradient (*a*) supposing that only the skin friction is considered; (*b*) supposing that both skin friction and the losses of head due to abrupt changes of section are considered. Write

[illegible] the expression for the several losses of head [illegible] Engineer."

It is not possible to draw the hydraulic gradient for this series of pipes, as the head lost by skin friction alone from the given conditions would exceed ten times the pressure head of 50 feet.

The discharge from the pipes since the velocity is 12 ft. per sec. in the 6-in. pipe

$$\frac{\pi d^2}{4} \times 12 = \frac{3{\cdot}1416 \times 12}{16} = 2{\cdot}356 \text{ c. ft. per sec.}$$

The head lost by skin friction is given by the following formula, given in Tudsbury & Brightmore's "Waterworks Engineering," which is a modification of Darcy's formula, viz. :—

$$h = \frac{lv^2}{1850 \cdot d}$$

where h = head lost in feet,

l = length of pipe in feet,

d = diameter of pipe in feet.

Treating each length of pipe separately, the 6-in. first—

$$h = \frac{5000 \times (2{\cdot}356)^2}{1850 \times (\frac{1}{2})}$$

$$\log h = (3{\cdot}6989 + 7{\cdot}4472 + 3{\cdot}2671 + 2{\cdot}4945)$$

$$= 2{\cdot}6816$$

$\therefore h = 478{\cdot}8$ feet.

$\therefore$ head lost by skin friction for 6-in. pipe = 478·8 feet.

By similar calculations the head lost in carrying the same quantity of water by the 9-in. pipe and the 12-in. pipe are 67 feet and 14·8 feet respectively.

$\therefore$ the total loss of head by skin friction

= 478·8 + 67 + 14·8 = 560·6 feet.

So it is evident that the conditions laid down are impossible.

An expression for the loss of head due to abrupt changes in the bore of the pipes can be deduced as follows : Bernouilli theorem states that the energy along any stream line in the pipes is constant and equal to—

$$\frac{v^2}{2g} + \frac{p}{w} + h = K \text{ say}$$

Where v = velocity in feet per sec.,

p = pressure in lb.,

h = height above a given datum,

w = weight of unit volume of water.

Let p and p_1 be the pressures in the two pipes in feet of water, v and v_1 the velocities in the two pipes ;

from the above $\frac{v^2}{2g} + p + h = \frac{v_1^2}{2g} + p_1 + h$

$\therefore p - p_1 = \frac{v_1^2 - v^2}{2g}$ but $p - p_1$ = loss of head due to change of bore.

$\therefore$ loss of head = $\frac{v_1^2 - v^2}{2g}$

To calculate the loss of head in the case under consideration. Since in each section of the pipes the product Av is constant where A = area of pipe in sq. feet,

v = velocity in feet per sec.

$\therefore$ the velocities in the 9-in. and 12-in. are 5½ and 3 feet per sec. respectively.

Substituting these values in the above formula.

Change from 6-in. to 9-in. pipe

$$p - p_1 = \frac{144 - (5\frac{1}{2})^2}{64} = 1{\cdot}77 \text{ feet.}$$

Change from 9-in. to 12-in. pipe

$$p - p_1 = \frac{(5\frac{1}{2})^2 - 9}{64} = {\cdot}33 \text{ foot.}$$

$\therefore$ total loss of head due to change of bore = 2·1 feet.

So even with these high velocities the loss of head from this source is comparatively small. (J. G. W., *Downpatrick.*)

Stone-cobbled Nish.—Like most Serbian towns, Nish lies in a flat, low-lying plain ringed about with hills. In wet weather, or after one of the terrific summer thunderstorms, the surface of the soil dissolves into almost unfathomable mud (writes a Serbian correspondent to the *Times*). The wide, irregular streets, therefore, are all stone-cobbled; but during these last years of war there has been no labour in Serbia to be spared for street repairing. In the latter part of the summer, indeed, the Government, by using the labour of Austrian prisoners, embarked on a heroic scheme of repairing the one main street leading from the railway station to the centre of the town. It was generally understood that this was being done because it was the route which Englishmen and other foreigners had necessarily most to use.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Chertsey U.D.C. (November 9th. Mr. P. M. Cross-Thwaites). £8,030 for works of sewage disposal. The surveyor, Mr. F. W. Greig, stated that the treatment of the sewage up to the present had not been quite satisfactory. An injunction had been obtained against the council to abate a nuisance at the farm. Answering Mr. Daw, Mr. Greig said the sewage farm was not at present being used, and practically the whole of the sewage was being temporarily treated in a field by broad irrigation. Mr. Scott-Moncrieff said the scheme briefly was to convert existing contact beds into upward contact beds, and to convert the second contact beds into percolating filters. The sewage was to be applied to these percolating filters by revolving sprinklers. Answering the inspector, Mr. Scott-Moncrieff said that in his scheme he did not propose to use the septic tanks, although they were available if necessary. He was adopting upward flow filtration because the results were much better than from contact.

Lanark C.C. (November 15th. Mr. David Ronald). This was an inquiry into the application of the Middle Ward District Committee of Lanark for authority to prepare a town planning scheme for Newton, Carnwyle, and Baillieston. The committee's town planning engineer, Mr. W. Ross Young, stated that the area which was the subject of inquiry consisted of 5,616 acres in the parishes of Cambuslang and Old Monkland, and wholly within the Middle Ward. The area was traversed by important highways carrying very heavy traffic. In many cases the existing roads were inadequate and congested. There was not an area in Central Scotland more likely to be built upon than the one included in the scheme. The factors which had conduced to its growth were still operative; indeed the need for housing within the area was likely to become urgent in the near future. The delay in securing good roads within the area had already become serious, while cross-river communication was at present very inadequate.

Walton-le-Dale U.D.C. (November 9th. Mr. A. W. Brightmore).—£17,950 for the reconstruction of the Chorley main road.—It was stated that the council asked for the maximum period for repayment. The road it was proposed to reconstruct, the clerk stated, ran through Bamber Bridge, and was the main trunk road through Lancashire, leading from Warrington and Manchester in the south to Lancaster and Carlisle in the north. The heavy motor traffic that passed over the road had left it in a bad state. The council proposed to reconstruct the road with 4 in. of tar-macadam on a 9-in. rubble foundation. It was also proposed to acquire a strip of land on the east side of Kellett-lane. It was not the intention of the council to borrow the money until times were more opportune. They made the application in order to have the scheme ready to start when the war was over, and if necessary to provide relief work.

APPLICATIONS FOR LOANS.

Darlington T.C.—£2,800 for coal-handling plant.

Fowey T.C.—£300 on works at the cemetery.

Hants C.C.—£16,000 for electrical plant for the Park Prewett asylum.

Hexham R.D.C.—£1,300, further instalment for sewerage works.

Lancaster T.C.—£4,200 for sewerage works.

Mountmellick R.D.C. — £3,000 for the Maryborough sewerage scheme.

LOANS SANCTIONED.

Amesbury R.D.C.—£3,629 for road repairs.

Leek R.D.C.—£2,400 for the Endon sewerage scheme.

Littleborough U.D.C. £2,000 for the electricity undertaking.

Shoreditch B.C. £1,500 in connection with the electricity undertaking.

FORTHCOMING INQUIRIES.

DECEMBER.	£
1.—**Failsworth.** For the purposes of public offices (Mr. W. O. E. Meade-King)	1,169
1.—**North Bromsgrove.** For works of sewage disposal (Mr. A. G. Drury)	3,100

FORTH AND WILSONTOWN WATERWORKS, LANARK.

The villages of Forth and Wilsontown are situated about 7 miles north of Carstairs Junction. Both are mining villages with a population of about 1,500, and the levels of the ground vary from 910 to 965 ft. above ordnance datum. Up till 1911 the water was derived from private wells, which were not only inconveniently situated for many of the inhabitants, but the supply obtained from them in the summer was quite inadequate to meet their requirements, and in some cases the quality of the water was unsatisfactory. The local authority had before them for a considerable time the question of providing a proper water supply for the villages, but owing partly to the high level at which they are situated, and partly to the houses being widely scattered, difficulty was experienced in devising a scheme which could be carried out at a reasonable cost. Ultimately the local authority purchased the right to the water from a spring on certain property, after which they formed a special water supply district under the provisions of the Public Health (Scotland) Act, 1897, and proceeded with the works necessary to make the water from the spring available for the supply of the district. The minimum yield of the spring is about 24,000 gallons per day, but as the spring is situated at a level of 820 ft. above ordnance datum, whereas the level of the highest part of the district requiring a supply was 965 ft. above ordnance datum, it was necessary to raise the water by pumping. Water is conveyed from the spring by gravitation through a cast-iron pipe of 4 in. diameter and 1 mile 4 furlongs in length, to the low-level reservoir at Lower Throughburn, and it is pumped up from there through a 5-in. diameter cast-iron pipe, 1 mile 3¾ furlongs in length, to a high-level reservoir at Forth, from which it is distributed throughout the district. The height of the lift is 240 ft.

Both the low-level and the high-level reservoirs were constructed of Mouchel-Hennebique ferro-concrete, the working drawings being supplied by Messrs. L. G. Mouchel & Partners, Limited, of Westminster and Glasgow. The low-level reservoir is rectangular in shape, and has a capacity of 40,000 gallons. It is constructed above ground, and has an engine-house at the end. The water is raised from this reservoir by a centrifugal pump driven by a 15-horse power oil engine.

In order to supply the highest parts of the district, provision was made in the scheme for a reservoir on the highest ground available at Forth; but the ground was too low for that purpose, and the reservoir had to be constructed in the form of a water tower, so that the bottom of it was 31 ft. above the surface of the ground. The reservoir proper is 26 ft. in diameter, with an overall depth of 14 ft., and a capacity of 40,000 gallons. The thickness of the wall is 5½ in. at the bottom and 4½ in. at the top.

Forth and Wilsontown Waterworks. High-level Reservoir.

There is an electrical connection between the engine-house and the high-level reservoir, and a water-level recorder is placed in the engine-house. There is also an arrangement for cutting off the engine when the high-level reservoir is full.

The low-level reservoir measures 40 ft. long by 20 ft. wide inside by 9 ft. 6 in. high, and provides for a depth of water of 8 ft. The engine-house, also built of ferro-concrete, is 20 ft. from front to back by 9 ft. 6 in. wide by 12 ft. 7½ in. high. The floor of the joint structure constitutes a general foundation raft, 4½ in. thick under the reservoir, from which rise the walls of the reservoir 5 in. thick at the bottom and 4 in. thick at the top, stiffened by counterforts spaced about 5 ft. apart. The roof is carried by six transverse beams, 7 in. wide by 13 in. deep, connected by a 3½-in. continuous slab, covered with earth to a depth of 6 in., as a protection against extremes of heat and cold. The engine-house walls are 4 in. thick, the floor being of the same thickness.

Structural details of the water tower are given herewith. The vertical section shows the main dimensions of the tower and elevated reservoir, as well as those of the principal members. The upper drawing at the right-hand is a plan of the horizontal bracing between the eight supporting columns, and the drawing beneath is a plan showing the bottom of the reservoir looking upwards. The reinforcement in both reservoirs is in accordance with the standard practice of Messrs. L. G. Mouchel & Partners, Limited, who were represented during the execution of the works by Mr. T. O. Dixon, their district engineer for Scotland.

The engineers for the scheme were Messrs. Warren & Stuart, MM.INST.C.E., of Glasgow. The pipes were supplied and laid by Messrs. Brown & Kincaid, Glasgow, and the whole of the ferro-concrete work was executed by Messrs. J. A. Mactaggart & Co., Glasgow. Both of the reservoirs were thoroughly tested for watertightness after completion, and although no special precautions were taken to make the concrete waterproof, the results were entirely satisfactory.

Institution of Civil Engineers.—On Tuesday next, at a meeting of the Institution of Civil Engineers, Mr. D. E. Lloyd-Davies, M.INST.C.E., will present a paper entitled "Harbour and Coast Defence Works at Alexandria." The chair will be taken at 5.30 p.m. On the conclusion of the business of the ordinary meeting, a special general meeting of corporate members will be held.

ROAD UPKEEP IN NORFOLK.

whether it was to the committee's advantage to

Fleet-street Widening.

poration have adopted a proposal to purchase, at a

Newspapers (Limited), in their leasehold interest in

Fleet-street.

Glasgow Tolbooth Steeple

ing of the Tramways

rebuilt at the corner of Gallowgate and London-street. The finding will now be intimated to the

tarring this year, which would mean an estimated

be done under a pledge given to the Road Board.

The chairman of the com-

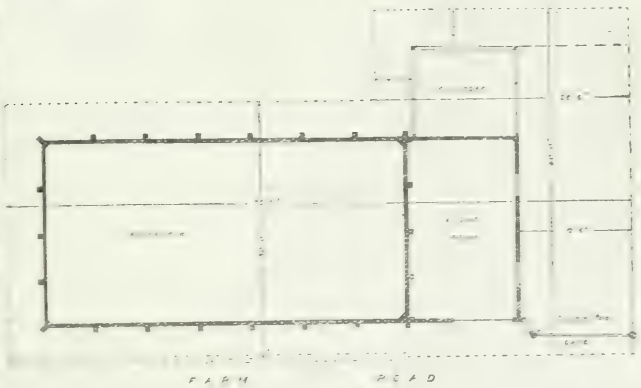
Parliamentary Retrenchment

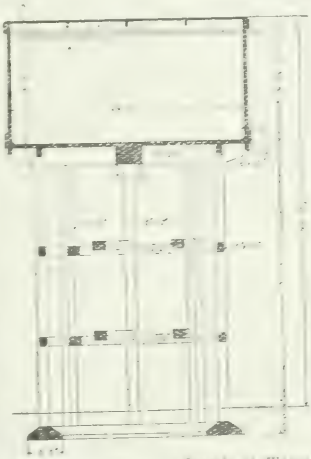
Another item

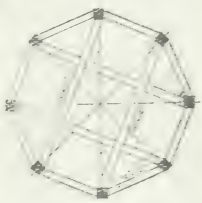
attention had been drawn to

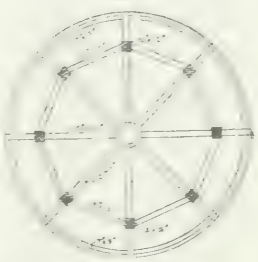
been told that since the great increase of motor traffic

made to them had been on the condition that they did









Municipal Work in Progress and Projected.

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The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Brighton T.C.—The borough surveyor, Mr. H. Tillstone, has prepared a report, giving details of work required to be carried out at certain of the cinematograph theatres, and stating that, in conjunction with the medical officer of health, he had visited the whole of the cinematograph theatres in the town, and inspected the system of ventilation of the buildings. It was recommended that the proprietors should be required to improve the ventilation of their buildings in accordance with certain rules.

Chelmsford T.C.—The borough engineer, Mr. P. T. Harrison, has prepared plans for an extension of the borough market buildings.

Hampshire C.C.—The Local Government Board have sanctioned the expenditure of the money required to complete the building of the Sholing girls' and infants' school.

Hatfield R.D.C.—The provision of a smallpox hospital is to come up for consideration at the next meeting of the council.

Stokesley R.D.C.—The council have approved the proposal of the county council either to rebuild Stokesley county bridge, or to strengthen the old bridge with concrete blocks.

Wallasey T.C.—The new town hall is rapidly nearing completion, and it is suggested that when the contractors have finished their work the building should be used as a military hospital. Accommodation could be provided for several hundred soldiers.

West Sussex C.C.—The architect has received instructions to prepare plans and invite tenders for repairs and the rebuilding of temporary offices at Plaistow school.

HOUSING AND TOWN PLANNING.

Greenock T.C.—The Housing Committee have been authorised to prepare specifications and obtain plans for a minimum of seventy-five artisans' cottages.

Dartford R.D.C.—A site of 4½ acres has been purchased for the erection of houses for munition workers.

Dublin T.C.—Arrangements have been made for a loan of £22,000 at 5 per cent for the erection of over 150 houses in the Ormond Market area.

PARKS AND OPEN SPACES.

Linlithgow T.C.—A recreation ground and gardens, which have been presented to the town by Colonel Charles Chalmers, of Longcroft, were formally opened last week.

REFUSE COLLECTION AND DISPOSAL.

Barking U.D.C.—Mr. Martin raised the question of the proposed fortnightly collection of house refuse, and said it was the wish of a very large number of people that there should not be any alteration. Mr. Edwards said the council asked for retrenchment, and this was the method they decided to adopt. Mr. Martin said it was a disgrace to the town that people should have house refuse left in their places for a fortnight. It was agreed that the medical officer should report to the Public Health Committee as to his views on the matter.

ROADS AND MATERIALS.

Argyllshire C.C.—The road surveyor to the Lorn District Committee, Mr. Kenneth Macrae, has received instructions to make surveys of alternative routes for the proposed new road from Ballachulish to Kinlochleven.

Ayrshire C.C.—With respect to the paving of Newstreet, Stevenston, which is nearing completion, the Northern District Committee have agreed to continue the work up to and beyond the railway crossing. The railway company, it was stated, would bear a share of the cost of this scheme.

Banff T.C.—A scheme has been approved for the straightening of the road from the Gas House towards Scotstown, at an estimated cost of £1,196, towards which the railway company will contribute £1,100.

Berks C.C.—Alderman Ferard, in proposing the adoption of the report of the Highways and Bridges Committee, referred to a petition from Swallowfield as to the dangerous condition of the Reading and Swallowfield main road. He said that the county had been "caught" by motor-'bus traffic, and the petitioners were perfectly right. The road was in a very bad state, and the committee were taking measures to see whether they could get something from that extraordinary traffic. It was a very serious matter. The county had "broken out" into motor omnibus schemes, and he understood that at the present moment there were no fewer than eighty-six motor 'buses every day going over their roads, several of which were new. No fewer than ten of these ran over the Reading-Swallowfield road.

Cardiff T.C.—The Public Works Committee are considering a scheme for widening Pencisely-road at its narrow part to 50 ft.

Charlton Kings U.D.C.—Sanction has been given to the diversion of the highway leading from Ryeworth-road to Whitington, at a point 300 yds. from the junction of Ham-lane and Mill-lane. The proposal will require to be confirmed by the justices.

Cheshire C.C.—The county surveyor, Mr. W. Holland, reported that he had, at the request of the chairman, most carefully considered the amounts provided in the estimates for the maintenance, repair, and improvement of main roads vested in both urban and rural districts, and for county and hundred bridges during the current financial year, and, having regard to the present exceptional circumstances, and while recognising the mistake it would be to let the roads down, he was of opinion that certain savings and reductions could be effected in the year's work without causing any serious deterioration to the roads. The committee must, however, clearly understand that if the proposed reductions were made, the standard of maintenance would be somewhat lowered. It was stated that there would be a reduction on the proposed expenditure of about £19,000.

Dudley T.C.—In connection with the housing scheme it is proposed to construct a main thoroughfare 40 ft. wide from St. John's-road to Birmingham-road, to widen St. John's-road and Bunn's-lane to 36 ft., and to construct several 30-ft. roads.

East Sussex C.C.—The council have agreed to the recommendation of the Roads and Bridges Committee that the whole of the road from Newhaven to Seaford proposed to be improved should be declared a main road when the works proposed by the Road Board to all three sections, and estimated to cost £10,589, have been carried out without expense to, and to the satisfaction of, the county council.

Egham U.D.C.—The road at the Rose and Crown Inn, Virginia Water, is to be widened at an estimated cost of £110.

Hampshire C.C.—The Road Board have sanctioned a grant of £7,000 towards the work of surfacing roads with Tarmac and tar-dressing, and sanction has also been given to a further expenditure of £30,000 on roads for military purposes.

Kent C.C.—An agreement has been reached with the Road Board with respect to the amount to be paid for making good the damage done by military traffic to the Newington-Cheriton road. A scheme has been agreed to for widening the main road at Crayford.

Okehampton T.C.—The council have approved the plans of the borough surveyor, Mr. D. V. Howard, for a 30-ft. road in Castle-road.

Oxfordshire C.C.—With respect to the Road Board county scheme, the Roads and Bridges Committee reported that the sum of £2,827 had been received from the Road Board since the date of the last report, making the total receipts £29,827, which includes £12,350 advanced by way of loan. The total expenditure under the scheme had amounted to £44,893, and the committee had applied to the Road Board for a further payment on account.

Stafford R.D.C.—An intimation has been received that the War Department had accepted the council's

cafes for the maintenance of the Milford and Broeton road.

Uckfield R.D.C.—Military requisitions have been served for road construction at Crowborough, and for the provision of material for cleaning and repairs at Crowborough Camp.

West Norfolk C.C.—The council have accepted a contribution of £633 from the Road Board for the repair and widening of the road from Southery to Brandon Creek. The cost of the scheme to the council is estimated at £1,428.

SEWERAGE AND SEWAGE DISPOSAL.

Battle U.D.C.—Efforts are being made to obtain a loan of £950 for sewage disposal works.

Brownhills U.D.C.—The council have accepted the scheme of the surveyor, Mr. J. H. Shaw, for the construction of works of sewerage.

Huntingdon T.C.—It has been agreed to carry out certain necessary works of sewerage renewals.

Street U.D.C.—The council have referred to the Sewage Farm Committee a report by the surveyor, Mr. W. G. Goode, for the improved working of the sewage farm with a view to the better distribution of the sewage and the production of the best effluent the land is capable of producing.

Tadcaster R.D.C.—It has been decided to carry out sewerage extensions at Allerton Bywater, and also an improvement at the main outfall.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C.—Consideration is being given by the Electricity Committee to a proposal for the purchase of new turbine plant for the electricity works, at an estimated cost of £16,000.

Cardiff T.C.—The electric installation at the new technical college is to be completed at a cost of £2,000.

Cheadle and Gatley U.D.C.—The surveyor, Mr. F. R. Gibbins, has been instructed to prepare a report upon an electricity scheme.

Dolgelly R.D.C.—Proposals are being considered for the improvement of the water supply.

Farnham U.D.C.—Advice is being taken upon the question of a supply of electricity for the Hale district.

Hoylandswine U.D.C.—It has been agreed to support the application of a private company for a Provisional Order for the supply of electricity, subject to a purchase clause.

Hull T.C.—An amended estimate has been agreed upon for electricity extensions amounting to £26,445, £20,000 of which will be obtained on loan.

Keighley T.C.—Mr. W. H. Murgatroyd asked recently if, in view of the shortage of water, the Health Committee had considered the advisability of staying their hand in regard to the putting of conveniences on to the water-carriage system. He would like to know how many such conversions there had been during the past twelve months, and the number of flushing cisterns. He was told there were cisterns of a capacity of 100 gallons which were flushing every twenty minutes. Alderman Midgley, in reply, said that the ordinary cottage-house cistern used on an average about 12 gallons of water per day, and if they had put in 1,000 conveniences during the last five years it would only mean an additional consumption of 12,000 gallons. An ordinary water-tap would run off that quantity of water in a day. If they were to-day making alterations to fifty conveniences it would only be a matter of 600 gallons a day, and that was not worth considering. The health of the town must be the first consideration; and if people did not know what was good for them the Health Committee had got to teach them.

Lancaster T.C.—The town council on Wednesday decided to apply for leave to borrow £30,000 for an extension of the waterworks necessitated by the prospective large increase of population due to Government works. The scheme includes the utilisation of the existing Abbeystead compensation reservoir. The Government is to be asked to make a grant in aid.

Llanfrechfa Upper U.D.C.—The surveyor, Mr. G. Jones, has been instructed to report on the question of the water supply.

Manchester T.C.—The Electricity Committee on Wednesday accepted a contract for additional plant to be installed in the Stuart-street works, and to be completed in about thirty weeks, which will to some extent relieve the tension caused by the increased demand for electricity.

Monaghan U.D.C.—The council have given permission to a company for the erection of poles and wires in connection with a proposed installation of electric lighting.

Pembroke (Co. Dublin) U.D.C.—Subject to the council being able to borrow the necessary money, it has been decided to carry out extensions at the electricity works.

Ryde T.C.—The Water Committee have been authorised to purchase a crude oil engine at a cost of £140.

Swanage U.D.C.—Lieutenant Dawes, R.E., who was responsible for the boring work on behalf of the War Office, attended and stated that no water had been found. The chairman, Mr. R. W. G. Reynolds, stated that he had been in communication with Messrs. Mansfield in reference to their water-finding instrument, and had received a telegram from them that they would be prepared to come to Swanage and locate one good spot to bore for water for the sum of £21. Lieutenant Dawes stated that he understood the War Office were allowed to spend up to £650 on behalf of the council, and as practically only half that amount had been spent up to the present, they were willing to bore in any given spot at a cost not greater than the unspent balance. The council decided to accept Messrs. Mansfield's offer.

MISCELLANEOUS.

Maldens and Coombe U.D.C.—It has been decided that any officer who enlists shall have his case for the payment of a proportion of his salary considered on its merits. The following amendment was moved, but was rejected: "That the council fall into line with the London boroughs, and in the case of all officials who enlist before November 30th, agree to make up their military pay to the amount of their present salaries, and to keep their places open for them, subject to the officers agreeing to return to the service of the council for at least one year after the conclusion of the war."

Tavistock R.D.C.—The council has resolved to get the surveyor, Mr. Harris, "starred" as an official who, in the interests of the community, could not be spared for active service.

Teddington U.D.C.—The tender of Messrs. Eastwood & Co. has been accepted for the supply of Portland cement and lime.

Concrete Institute.—Ordinary general meetings of this body will be held in the offices of the institute, Denison House, 296 Vauxhall Bridge-road, Westminster, on January 19th, February 16th, March 15th, April 19th, and May 17th. A paper will be read at each meeting.

Sheffield Town Planning Schemes.—The work of town planning in Sheffield during the past twelve months has been chiefly confined to the areas already in hand, progress having been made with the schemes under consideration. Negotiations, we gather from the annual report of the city engineer, Mr. Charles F. Wike, M.INST.C.E., have taken place and conferences held with the owners respecting certain areas, and while the main features of the schemes have been adhered to, in some cases amendments have been accepted to meet the proposals of the owners. A table in Mr. Wike's report shows that the area of town planning schemes now in hand is nearly 6,000 acres. This is about one-half of the total area of land within the city available for town planning, and roughly 25 per cent of the total area of the city.

FOR OTHER ADVERTISEMENTS
See End of Paper.

HORSHAM RURAL DISTRICT COUNCIL.
TENDERS FOR TAR.

The above Council invite Tenders for the Supply of Tar for Season 1916. Estimated quantity about 25,000 gallons. Full particulars and Forms of Tender to be obtained on application.

Last day for receiving Tenders, December 13, 1915.

W. DENGATE,
Surveyor.

58 Park-street,
Horsham.
November 23, 1915. (2,775)

PERSONAL.

Mr. C. Blaney, surveyor to the Newry Urban District Council, has had his salary increased from £200 to £300 a year.

Mr. P. Taylor, surveyor to the Hampton Wick Urban District Council, is applying for a commission in H.M. Forces.

Mr. W. H. Eley, surveyor to the Newmarket Urban District Council, has taken up a commission in the Royal Engineers.

Mr. H. Ernest Denham, articled pupil to Mr. S. A. Hill-Willis, engineer and surveyor, Tilbury Urban District Council, has been accepted into the Engineer unit of the University of London Officers' Training Corps.

Mr. A. R. Howlett, a member of the staff of the Bethnal Green surveyor's department, who for some months past has been serving in the Honourable Artillery Company, recently returned from the Front and was gazetted Second Lieutenant in the Royal Engineers on October 17th.

Mr. H. J. Chapman, who has resigned the position of surveyor and sanitary inspector for Buckingham on his appointment to a similar position under the Hartshorne and Seals Rural District Council, was recently presented with an oak timepiece by the employees of the town council as a token of their esteem and appreciation.

Mr. Robert Henry Bicknell, engineering inspector under the Local Government Board since 1896, has retired, and the good wishes of a host of friends will

Mr. R. H. Bicknell.

go with him into private life. His strenuous and varied career began—after leaving Marlborough College—with his apprenticeship to ironmasters at Stockton-on-Tees, after which he worked as an improver with Messrs. Head & Wrightson, and Messrs. R. Rogers & Co., of the same town. Subsequently he was placed in charge of the piercing by machinery of Lees Moor and Wellhead railway tunnels, and his experience of tunnelling was afterwards extended in connection with the Channel Tunnel experimental works on both the English and French coasts. Next he had charge of the excavation of the Elderslie Rock in the Clyde by diamond drills, and also superintended the driving of the Halkyn deep drainage adit (Flintshire). Railway and aqueduct works then claimed his attention, and he was also a member of Mr. T. A. Walker's staff of constructive engineers in connection with the Manchester Ship Canal. Upon his return from South America, where he was engaged in railway engineering, he was placed in charge of the constructional department of the Collooney and Claremorris Railway undertaking. Before he took up his duties at the Local Government Board he was engaged in private practice, and was engineer to the Fen Commissioners, in which connection he had charge of about 250 square miles of drainage, and the navigation of the main rivers in that area, while he also rebuilt the outfall sluice and navigation lock. It need only be added that Mr. Bicknell has always fulfilled his inspectional duties with tact and judgment. He is a member of the Institution of Civil Engineers, and an honorary member of the Institution of Municipal and County Engineers.

Mr. A. J. Smith, borough surveyor of Lynn, requested the town council to sanction his application for a commission in the Royal Engineers, and the Streets, Buildings, and Markets Committee recommended that the request be complied with, but that steps be taken to ensure his remaining in his official position as long as was reasonably possible. The town council, however, deleted this part of the committee's report, the mayor, Mr. R. O. Ridley, remarking that the borough surveyor did not want to be fetched. In doing what he had done he was putting his King and country first.

At a joint meeting of the Eastern and Western Highways Committee, held at the Shirehall, Norwich, recently, special tributes were paid to the memory of the late Mr. T. H. B. Heslop, and a vote of condolence with the widow and family was passed. Mr. Hamon le Strange, who presided, said they had in their late county surveyor an instance of the highest type of public servant, for Mr. Heslop was a man who not only knew thoroughly well how to do his duty, but who also did it with all his heart. To Mr. Heslop it was always a matter of the greatest pleasure to undertake any new work.

SHEET PRISMATIC-LENSE GLASS.

Only too frequently is it the case that, owing to the lack of a suitable system of glazing, artificial illumination is resorted to in situations where the natural daylight might be successfully utilised. In this connection attention may be drawn to the system of sheet prismatic-lense glass of the Maximum Light Window Glass Company, 28 Victoria-street, London, S.W., by which it is claimed an increase of daylight from five to twenty times is rendered possible; and all who are interested in the "daylighting" of factories, shops, warehouses, schools, and hospitals would do well to obtain a copy of an illustrated booklet which has been issued by that firm. "Maximum" is stated to be the first glass ever produced in sheet form with scientifically shaped projections on each side of the sheet. At present it is being supplied in four different angles, and the company contend that architects need not have a dark corner in any room if they apply it to certain windows. The glass should be especially effective in narrow streets, areas and basements, and the slight extra cost which its provision entails should prove a really good investment.

Hartlepool Housing Scheme. — The Hartlepool Town Council have accepted a gift of £1,500 from Mr. William Crosswell Gray, a local shipbuilder, towards a housing improvement scheme adopted by the council, at the estimated cost of £15,000. Mr. Gray mentioned that his offer was chiefly a small token of gratitude at the favourable news he had received that his only son, Lieutenant Gray (who has been wounded and captured), was alive.

Business Announcement.—In consequence of the rapid expansion of their trade in plastic and other cements, and in their fibrastic seating and packing for tramway rails, Messrs. Robbins & Co., 11 Tothill-street, Westminster, S.W., have found it imperative to introduce further capital into their business, and, to facilitate this, they have registered a private company with the title, "Plastic Cements and Fibrastic, Limited." The enlarged business will, however, be carried on under the same management as before, and all orders will, as heretofore, receive the personal attentions of Mr. James Robbins and of those hitherto associated with him in the business, while the company's extended facilities for production will now enable them to execute even the largest orders with accuracy and despatch.

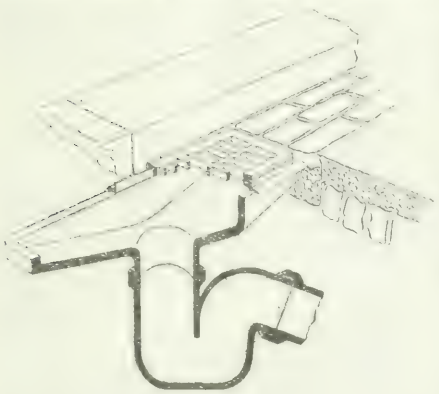
A NEW TYPE OF STREET GULLY.

(From a Correspondent.)

[illegible] intervals, and especially after any considerable [illegible]

[illegible] that systematic cleaning out of gullies is under- [illegible] way, the grit from such an area may often be enough to fill the pot fairly quickly, after which any further grit passes, of course, to the sewers. It is thus not improbable that the pot is often but a reservoir retaining putrefying filth on the side of a busy street, just in the position where it is likely to cause most harm to public health.

The pot gully and the sump manhole are no doubt brothers of the same epoch. The latter has gone: the former may follow suit, when it is considered how objectionable it is, not only on sanitary grounds, but when, further, it is remembered that road construction has entirely changed since it was [illegible]



when sanding is necessary, during but few days of the year, and no up-to-date engineer lays a sewer likely to have a velocity insufficient to carry away road grit.

The borough engineer of Newark has just registered a new design of road gully; its construction will be seen from the illustration reproduced herewith. The gully consists of two parts, a glazed stoneware receiver, fitted on to an ordinary "Q" trap. The collector is 24 in. long by 7 in. broad; at the ends it is only 1 in. deep, while its depth at the centre is only 3½ in. In towns with a separate system of sewerage the trap may, of course, be omitted.

The objects kept in view in designing this gully were: (*a*) To pass all mud and filth to the sewers at once, and not to intercept and retain it to putrefy under the noses of pedestrians.

(*b*) To obtain a cheaper type of gully and cover than that hitherto on the market, in addition to a more efficient one.

(*d*) To obtain a gully which will not readily choke with leaves, and which will not allow channel streams of high velocity to jump the cover. The extreme length of the cover will be noticed.

(*e*) To obtain a really accessible trap, which can be at once cleaned out with a rubber plunger should it choke.

The design has been well tested, and Newark Corporation have decided to replace the old types of gully with this new type, at a certain rate per year.

Lancashire Main Roads.—At a meeting recently of the Lancashire County Council, Alderman Aspell, in [illegible] the report of the Main Roads and Bridges Committee, said that, although certain main roads really required reconstruction, the committee had been compelled to resort to patching, in consequence of the [illegible] refusing to sanction capital expenditure on roads. The committee were conscious [illegible] was [illegible] being wisely spent. With a view to economy they were seeking to arrange for using alternative roads for heavy traffic.

SOME RECENT PUBLICATIONS.*

Australasian Roads (Second Edition). By J. M. and H. E. Clare. Price 21s. nett. Sydney: George Robertson & Co. Proprietary, Limited. London: St. Bride Press, Limited, 21 Bride lane, E.C.

The kindly appreciation of the first edition shown by engineers, universities and technical schools, examining boards, municipal bodies, and others, having led to the exhaustion of the whole of that issue, the authors have not only revised and largely rewritten the original work, but have greatly extended its scope and utility. The number of pages has been increased from 331 to 560, and that of the illustrations from 146 to 228. A copious index contributes to be a feature of the book.

All important recent developments in the design, construction, maintenance, and cleansing of roads and pavements have been described, after much actual observation by the authors in Europe, America and North Africa, in a practical and comprehensive manner, with special regard to Australasian conditions. The results of the three International Road Congresses held since the first issue, in Paris, Brussels, and London, have been made full use of. Cost data applicable to Australasian conditions have been completely revised and considerably extended. Complete specifications, covering every branch of road engineering in the city, town and country, have been brought up to date and added to. Asphalt and tarmacadam roadways have been comprehensively treated, and scientific but easy tests, that can be conducted by any engineer, have been described for asphalt and tar, and have been illustrated where necessary. In extension of the scope of the original [illegible] many new chapters and an appendix, on subjects [illegible] road making and maintenance, have been included. Thus, in regard to reinforced concrete, underlying principles have been simply and concisely explained, and actual examples in design have been worked out for the student. With the aid of the rules, tables and diagrams given, the engineer should be able to design various classes of reinforced concrete structures, and to check designs submitted by others. In regard to hydraulics, too, in addition to an explanation of the science of the subject, the rules, formulæ and extensive tables given [illegible] cases that the engineer is likely to be called upon to deal with.

Electric tramways on roads are also dealt with, and in addition to a general description of tramway systems, the question of track surfacings is considered in detail. Storage battery, petrol-electric and railless systems of traction are also described, and important details furnished.

The subject of house refuse disposal has been [illegible] treated, and many data applicable to Australasia, hitherto unpublished, have been included. Refuse destructors of various types have been described and illustrated, the advantages and disadvantages of the several systems being discussed. The generation of electricity, and the uses to which by-products can be put in road making, have been closely gone into.

The book is one which ought to be on the shelf of every highway engineer.

The Practical Design of Steel-framed Sheds. By Albert S. Spencer. Price 10s. 6d. nett. London: Constable & Co., Limited.

This book is intended for those who require a specialised knowledge of the practical design of shed framework and foundations. In the consideration of each constituent part the author has borne in mind its relation to the completed structure as a whole. The book thus possesses a unity and coherence of treatment which is wanting in more general treatises which only deal with the subject of sheds incidentally. The first chapter deals with the resistance of steel-framed sheds to wind forces, while subsequent chapters treat of standard sections of sheds, and the standardisation of members and foundations. Finally, external coverings, gutters, pipes, ventilation and other similar incidental matters receive consideration. The work may be recommended as a very useful text-book. One criticism, however, may be made in regard to its form, and that is that the [illegible]

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*Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

excellent plates that are bound in at the end of the volume when extended are not completely visible, being partly covered by the intervening pages of text. Reference would have been easier if the concerned pair had been folded and the parts in the extended accordingly.

Applied Mechanics. By Ewart S. Andrews, B.Sc. Price 4s. 6d. Cambridge University Press.

In this book the aim of the author has been to present the elementary principles of mechanics in accurate, though clear, terms, and to show the application of those principles to the simpler problems arising in engineering and architectural applications. The ordinary subjects of a thorough course in applied mechanics are dealt with in logical order, and considerable prominence is given to graphical methods. Prof. Andrews' wide experience as a teacher has enabled him to present the subject with exceptional clearness, and to anticipate many of the ordinary difficulties of students. Further, although he has succeeded in avoiding a too theoretical treatment, he has, nevertheless, given quite sufficient explanations of mathematical principles to enable the reader intelligently to follow him into the realm of practical engineering application. Each chapter concludes with a short summary and a series of questions. We have no hesitation in recommending this book to students who desire a clear exposition of the subject of applied mechanics.

A Manual for Health Officers. By J. Scott MacNutt. Price 12s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

Although this book is primarily concerned with American practice, it contains much information which is of interest to the medical officer of health and sanitary inspector in this country. The first part deals with the organisation and powers of health authorities, while the general subject of the remainder is public health administration. The particular topics include communicable disease, child hygiene, milk and other food supplies, water supplies, housing and industrial hygiene, nuisances, sanitary law, the annual report, vital statistics, and publicity. These are all dealt with in some detail, and the result is a book which should prove of practical value, not only to health officers, but also to all who are in any way interested in the problems of public hygiene and preventive medicine.

Limes and Cements. By E. A. Dancaster, B.Sc. Price 5s. nett. London: Crosby Lockwood & Son.

There are probably no materials of engineering construction that are of more general importance than limes and cements. For this reason no doubt the subject has produced a considerable literature of its own. So far as we are aware, however, there is no work extant which covers exactly the same ground as that before us. Described in the sub-title as an elementary treatise, it contains a brief account of the nature, manufacture, and uses of limes and other calcareous cements, while the subjects of chemical analysis and physical and mechanical tests are also dealt with. The author has produced a work which, while specially useful to the beginner, also contains much information which will be useful to those whose knowledge of the subject is more advanced.

Practical Shop Mechanics and Mathematics. By J. F. Johnson. Price 4s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

In this book the mechanic or trade student will find a concise and clear arrangement of those simpler branches of applied mechanics, and the mathematics directly related to them, that pertain to actual shop conditions. The subjects dealt with include materials, measuring instruments, pulleys and belting, tooth gearing, force and work, forces, stress and strain, and angle measurements. Rules and formulæ are invariably illustrated by practical examples, the solutions of which are worked out in full detail. The book may be profitably studied by those for whom it has been written, either in private or in the technical school.

Arithmetic for Carpenters and Builders. By R. B. Dale. Price 5s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

This book presents in a simple manner the subjects of arithmetic, together with some geometry and mensuration, as used in the daily work of the carpenter and builder. The scope is quite elementary, and the several lessons are well graduated. The carpenter or practical builder who has mastered its contents will certainly have a more intelligent grasp of his work in consequence of the knowledge so gained.

Mortality Laws and Statistics. By Robert Henderson. Price 5s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

The author of this book is the actuary of the Equitable Life Assurance Society of the United States, and the work sets forth in concise form the essential facts and theoretical relations with reference to the duration of human life. Several useful tables are contained in an appendix.

COUNTY SURVEYORS' SOCIETY.

At a meeting held on the 17th inst. the death of the hon. secretary and treasurer of the County Surveyors' Society (Mr. T. H. B. Heslop, M.Inst.C.E.) was formally announced by the president, and a vote of condolence with his family was passed.

At the request of the society, Mr. H. T. Wakelam, M.Inst.C.E., county engineer, Guildhall, Westminster, S.W., consented to act as hon. secretary and treasurer, and all communications should be sent to him in future.

Demand for Electricity in Manchester.—The Electricity Committee of the Manchester Corporation record a great increase in the consumption of electrical current. The increase in the demand for current for power purposes is fully 30 per cent in excess of that which was called for in pre-war times. The increase, great as it is at present, will, the committee expect, be much more before the winter is out.

Housing Loans.—In the House of Commons last week, the President of the Local Government Board was asked whether he was aware that the Dublin Corporation had acquired sites and condemned and demolished thousands of insanitary dwellings within the last two years; and, as this was done in the belief that the Local Government Board would sanction the loans to build houses for the working classes, would he state whether his board would withdraw their opposition and thus allow the corporation to receive grants sufficient to enable them to continue the housing of the workers. The Chief Secretary for Ireland, who replied, stated that the corporation had since the commencement of the war received the sanction both of the board and the Treasury amounting to £75,000 in respect of some large building schemes. Regarding more recent schemes, loans to defray compensation claims had been sanctioned, but the question of sanctioning further loans for the erection of houses had been deferred for the present in accordance with the board's circular of May 4th last conveying the Treasury restrictions as to capital issues. That circular applied to all local authorities.

Motor Fire Appliances for London Brigade.—At a recent meeting of the London County Council the Fire Brigade Committee reported that they had had under consideration the question of the arrangements to be made for the purchase of motor fire appliances during the financial year 1916-17, in pursuance of the scheme for the motorisation of the fire brigade. They proposed that ten motor fire engines and ten motor escape vans should be obtained, and they had ascertained that these appliances could be obtained at a cost of about £17,960. In order that the appliances might be delivered as early as possible in the ensuing financial year, it was necessary that they should be placed on order at an early date, and in the circumstances they had asked the Finance Committee to submit a capital estimate of £17,960. It would be necessary to obtain the consent of H.M. Treasury before incurring the expenditure. Provision for the expenditure would be made in the draft estimates for 1916-17. The committee added that they were now advised that the cost of completing the equipment of the brigade with motor appliances would probably be about £25,000 less than the amount of £160,000 originally estimated. The reduction was due partly to the prices of the appliances having been lower than was anticipated and partly to the fact that it had not been found necessary to place appliances out of commission for repairs as often as was expected.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

BOROUGH SURVEYOR AND ENGINEER.—December 11th.—Corporation of Hertford. £350 per annum. Town Clerk, The Castle, Hertford.

BOROUGH SURVEYOR.—December 13th.—Stratford-upon-Avon Corporation. £275 per annum.—Mr. R. Lunn, town clerk.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

KILKENNY.—November 30th.—For the construction of a reinforced-concrete bridge, for the Kilkenny and Wexford County Council.—Mr. A. M. Burden, county surveyor, Kilkenny.

LONDON.—December 1st.—For the extension of washing shed and other works, for the Metropolitan Asylums Board.—Board Offices, Embankment, E.C.

SLIGO.—December 14th.—For the erection of a pavilion, construction of water supply and sewage works, and other works, for the county council.—Mr. M. Keane, secretary, Court-house, Sligo.

BRADFORD.—December 15th.—For the execution of repairs to buildings, for the Commissioners of Works and Public Buildings.—The Secretary, Storey's-gate, London, S.W.

Engineering: Iron and Steel.

ASHTON-UNDER-LYNE.—November 29th.—For the supply of one 100-gallon pneumatic ejector for humus sludge, for the corporation.—Mr. J. Rowbottom, Town Hall, Ashton-under-Lyne.

DUNDEE.—November 29th.—For the supply of 600 tons of steel tramway rails, and 15 tons of steel tiebars, for the town council.—Mr. J. Thomson, city engineer.

SALFORD.—November 29th.—For the supply of manganese steel crossings, for the corporation.—General Manager, Corporation Tramways, 32 Blackfriars-street, Salford.

ADWICK-LE-STREET.—December 1st.—For excavating and refilling 600 yds. of trench for water main, for the urban district council.—Council Offices, Old School, Adwick-le-Street.

ORMSKIRK.—December 1st.—For the supply and erection of a Lancashire boiler, for the guardians.—The Master, Poor Law Institution, Ormskirk.

MILTON REGIS.—December 6th.—For re-setting two beds of six retorts with regenerative setting, for the urban district council.—Mr. H. W. Kaye, The Gasworks, Milton Regis, Kent.

ATHENS.—December 17th—30th.—For the maintenance and working of the undertakings necessary for the water supply, and laying a distributing system.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

WARRINGTON.—December 18th.—For mechanical tipping apparatus for coal wagons, for the corporation.—Mr. W. S. Haddock, general manager, Gas Offices, Warrington.

JOHANNESBURG.—December 30th.—For the supply and erection of ice-making and refrigerating plant, for the municipal council.—Intelligence Branch of the Board of Trade, 73 Basinghall-street London, E.C.

Roads.

WHITLEY.—November 29th.—For the supply of team labour for various departments, for the urban district council.—Mr. A. J. Rousell, surveyor, Whitley Bay, Northumberland.

WOMBWELL.—November 27th.—For the supply of granite, limestone, tarred dross, slag, basalt, dross chippings, limestone, asphalt, cement, setts, kerb, channelling, flags, and stoneware pipes, for the urban district council.—Mr. W. Quest, surveyor, Town Hall, Wombwell.

CLEETHORPES.—November 29th.—For the supply of 200 tons of slag chippings, for the urban district council.—Mr. L. W. Pye, acting surveyor.

HAMPTON WICK.—December 3rd.—For the supply of about 200 yds. of granite, for the urban district council.—The Surveyor, Council Offices, High-street, Hampton Wick.

BRENTFORD.—December 4th.—For the supply of 200 yds. of blue Guernsey or other approved granite, for the urban district council.—Mr. J. W. Croxford, surveyor, Clifden House, Boston-road, Brentford.

GLANFORD BRIGG.—December 4th.—For making up certain streets and back roads, for the rural district council.—Mr. W. H. Buttrick, engineer, High-street, Scunthorpe.

DERBYSHIRE.—December 9th.—For the supply of broken stone and tar-macadam, such as granite, basalt, slag, limestone, or other suitable materials, for the county council.—Mr. J. W. Horton, county surveyor, County Offices, St. Mary's-gate, Derby.

HORSHAM.—December 13th.—For the supply of tar, for the rural district council.—Mr. W. Dengate, surveyor.

WILTS.—December 15th.—For the supply of granites, basalts, limestones, chippings, tools, implements, Tarvia spraying, and steam rolling, for the county council.—Mr. J. George Powell, county surveyor, Trowbridge.

DORSET.—January 7th.—For the supply of broken granite, basalt, quartzite, limestone, and tar-macadam, for the county council.—Mr. E. H. Habgood, acting county surveyor, County Offices, Dorchester.

Sanitary.

HAMPTON WICK.—November 26th.—For the supply of men, horses and carts for scavenging, and for the weekly collection and disposal of house refuse, for the urban district council.—The Surveyor, Council Offices, High-street, Hampton Wick.

GLASGOW.—November 27th.—For the construction of pipe sewers and roads, for the corporation.—Office of Public Works, 64 Cochrane-street.

PRESTWICH.—November 29th.—For the construction of a 12-in. sewer, for the urban district council.—The Surveyor, Chester Bank.

SPALDING.—December 4th.—For work in connection with the disposal of sewage, for the board of guardians.—Mr. H. Stanley Maples, clerk.

GILDERSOME.—December 6th.—For emptying and cleansing ashpits, for the urban district council.—The Surveyor, Council Offices.

HASTINGS.—December 6th.—For laying stoneware pipe sewer and other work, for the corporation.—Mr. P. H. Palmer, borough engineer, Town Hall, Hastings.

CHEPPING WYCOMBE.—December 6th.—For the supply of stoneware pipes, for the corporation.—Mr. T. J. Rushbrooke, borough surveyor.

Stores.

RHONDDA.—November 30th.—For the supply of stoneware pipes for sewers and surface-water, bass brooms, rotary brushes, ironmongery, picks, shovels, road scrapers, tools, steel standards, iron castings, street gratings, manhole covers, paving, kerb, channel, pitching and coping, Portland cement, granite road macadam, and limestone macadam, for the urban district council.—Mr. E. H. Barber, engineer and surveyor, Council Offices, Pentre, Rhondda.

NOTTINGHAM.—December 2nd.—For the supply of blue bricks, stoneware pipes, castings, iron gullies, Yorkshire flags, kerb, granite setts, broken granite, ironstone slag, chippings, river gravel, ironmongery, and refined tar, for the corporation.—Mr. A. Brown, city engineer.

OTLEY.—December 31st.—For the supply of setts, kerbs, flags, granite macadam, pitch, tar, slag dust, tar-macadam, limestone macadam, and brushes, for the urban district council.—Mr. C. F. Hodgson, surveyor.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

An Eastern Sub-District meeting (Suffolk, Norfolk and Cambridge) will be held at Bury St. Edmunds on Saturday, December 4th.

Programme.

2 p.m.—Meet at Shire Hall, where the members will be received by Mr. W. Lionel Jenkins, assoc.m.inst.c.e., a.m.i.mech.e., a.i.e.e., p.a.s.i., &c., county surveyor, West Suffolk County Council.
Read minutes of previous meeting.

2.30 p.m.—Mr. William H. Eley, assoc.m.inst.c.e., engineer and surveyor, Newmarket Urban District Council, will read a paper on "War-time Economy by Local Authorities;" discussion.

4.30 p.m.—Afternoon tea at "Forrest Dean," by kind invitation of Mr. W. Lionel Jenkins.

Mr. Walter D. Harding, assoc.m.inst.c.e., borough surveyor and water engineer, Bury St. Edmunds, will be pleased to show, between 10 a.m. and 12 noon, any of the members who wish and communicate with him, the waterworks electric power station and destructor.

J. R. Mead, *Hon. Sub-District Secretary.* H. T. Wakelam, m.inst.c.e., *District Chairman.*

INSTITUTION OF MUNICIPAL ENGINEERS.

The seventh annual general meeting will be held in London to-morrow (Saturday).

Programme.

11.30 a.m.—Council meeting.
11.45 a.m.—Meet in the council chamber, No. 4 Southampton-row, W.C.
12 noon.—Annual general meeting.
Minutes of last meeting.
Presentation of annual report of council.
Announcement of result of ballot for election of council for the year 1915-16.
Installation of president.
Any other business.
1 p.m.—Adjourn for lunch.
2.30 p.m.—Reassemble in council chamber.
2.45 p.m.—Presidential address.
Discussion on the following papers to be presented to the meeting:—
"The Manufacture of Cement," by Horace Boot (past-president).
"The Benefits Derived by an Urban District Adopting a Town-planning Scheme," by W. L. Carr (member).

Advance copies of papers may be obtained on application to the secretary, and will be forwarded as soon as the papers are in print.

Ladies are invited to attend the meeting.

B. Wyand, *Secretary.*
39 Victoria-street, S.W.

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

The fourteenth annual general meeting of this association will be held in the Caledonian Salon, Holborn Restaurant, London, on Thursday, December 9th, at 3 p.m.

Papers: "The Work Done at Salford by the Activated Sludge Process," by W. H. Duckworth, f.c.s., and "Recent Improvements in the Construction of Cultivative Tanks," by W. D. Scott-Moncrieff, m.i.mech.e., f.r.s.i., past-president.

Discussion.

J. B. Croll, *Hon. Secretary.*

INSTITUTION OF WATER ENGINEERS.

The twentieth annual winter meeting will be held at the Geological Society's apartments, Burlington House, W., on Friday, December 10th, commencing at 2.30 p.m. A discussion will be invited on "The Necessity for Defining the Term 'Domestic Purposes' in General and Private Water Acts."

The election of the president and council for the year 1916-17, also the election of the auditors for the year 1916 will take place at this meeting.

Percy Griffith, *Secretary.*

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance
‡ Provisionally accepted

BROWNHILLS.—For laying stoneware pipe sewers and manholes, for the urban district council.—Mr. J. H. Shaw, engineer and surveyor:—

A. Hill & Co., Kidderminster	£1,820
W. S. Scott & Co., Luton, Beds.	1,200
C. Jackson, East Tipton, Staffs	1,154
Child & Withers, Bilston, Staffs ..	930

LEWISHAM.—For kerbing, channelling, and making up the roadway, and for paving the footways of Manwood-road with artificial stone, for the borough council:—

	Roadway. £	Footways, at per yd super s. d.
H. Woodham & Sons	1,859†	–
J. Mowlem & Co., Limited	1,869	
W. Pearce	1,905	3 11
Fry Brothers, Limited	1,916	
W. Manders & Co.	1,983	4
Willis & Powis	2,000	4 3
Foote & Milne, Limited ..	2,016	4 1
Davey & Armitage	2,350	5 9
Atlas Stone Company, Limited	—	5 9
Alexandra Paving Stone Co., Limited	–	4 3
Brookes, Limited	—	4 3

NEWPORT (I.W.).—Tenders have been accepted by the corporation for the supply of the following materials:—
Supplying to the Sewage Works of Fresh Greystone Lime.—E. Rogers & Son, £1 2s. 6d.
Supplying to the Sewage Works of Press Plates.—Smith & Whitehead, £5 10s. each.
Supplying Materials for the Waterworks.—Smith & Whitehead and A. Wood.
Supplying of General Materials to the Corporation.—H. W. Morey; Associated Portland Cement Companies; T. Rogers & Son; Duke Brothers; Westmores, Limited; W. Wells; Smith & Whitehead; Wheeler & Hurst; F. P. Spencer.

TRAM TOOLS of every description.
RAILWAY TOOLS of every description.
JOHN YATES & CO., Ltd.
Aston Manor, BIRMINGHAM.
Manufacturers of
PERMANENT WAY, POLE HOLE, and POWER STATION TOOLS, BARROWS and APPLIANCES.
TELEGRAMS: "YATONIAN, BIRMINGHAM."
TELEPHONES: EAST 400, 401 & 402.
ESTABLISHED 1804.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. DECEMBER 3, 1915. No. 1,246.

Minutes of Proceedings.

Some Results of Hypochlorite Treatment of Water.

In reading the many papers and articles which have been written upon the subject of the treatment of water with hypochlorite, it is impossible to escape the idea that the various workers sometimes pay very little attention to what the others are doing. While in some cases we have the most careful and elaborate arrangements for previous treatment of the water—the hypochlorite being used only as a final method of purification—we find other cases where the chemist is still endeavouring to treat water containing comparatively large quantities of organic matter, or where the materials which have been found unsuitable elsewhere are used for mixing tanks, or for valves, and so forth, and where the well-known clogging action of the hypochlorite on pipes and apertures through which the solution has to flow is looked upon as something new and unexpected. However, it is probably wrong to conclude that results of this kind are due to want of knowledge. Such can hardly be the case, and it is perhaps well that the chemist should not be too ready to take for granted all that is published by other workers, and if some of the results obtained merely agree with what has gone before the additional proof is valuable.

Still, in reading the paper read by Mr. Joseph Race before the Canadian Section of the Society of Chemical Industry, one cannot help wondering why, in the face of the acknowledged unsuitability of wooden tanks for the mixing of a strong hypochlorite solution, the Ottawa authorities only two years ago, in constructing a 20,000,000-gallon plant, should have used wooden mixing tanks which afterwards had to be lined with concrete and asphalt. One may again ask why asphalt was used, seeing that concrete has apparently proved to be a very suitable lining elsewhere. In fact, the latest practice appears to be to make the tanks of plain reinforced concrete. Mr. Race also makes a strong point of the fact that, while the solution does not corrode the pipes, it tends to clog them, and advises the use of cleaning eyes on the pipes. This again appears to be ele mentary. On the other hand, the paper contains matter of a very different kind and information of peculiar value. The clear proof of the value of thoroughly mixing the solution with the water is important. Efficient mechanical mixing clearly produces superior results with a smaller consumption of chlorine, and it is shown that the better mixing of chlorine gas with the water, as compared with the mixing of hypochlorite solutions, may be taken as the reason for the better efficiency claimed in that process.

At Ottawa a considerable saving in chemicals was effected as the result of this improved mechanical admixture of the solution with the water. The evidence given of the velocity of the reaction on the micro-organisms being lowered by the temperature is also very interesting. Mr. Race is of opinion that the larger quantity of hypochlorite required in order to sterilise water containing organic matter may be much reduced if the solution is thoroughly mixed with the water, because imperfect admixture leads to prolonged localised action on the organic matter. With regard to this, he shows that at freezing point three times as much chlorine is needed for water containing much organic matter as would be needed at 70 deg. Fahr. Whether Mr. Race thinks that it is practicable to purify such water by hypochlorite treatment alone is not clear, but it seems that he, at any rate, has leanings towards the idea. On the other hand, he seems to consider that even the addition of ·5 parts of chlorine per 1,000,000 may cause trouble. The treated water when boiled has a fishy smell, we are told, and it is somewhat remarkable that large animals refuse to drink it. Water containing as much as 1·5 parts of chlorine per 1,000,000 does not appear to harm fish, however. The good results of the treatment of the Ottawa water are made clear first by the great fall in the typhoid rate, and next by the comparative freedom of the city from typhoid at a time when the water supply was known to be badly polluted, and when the town of Hull, drinking the same polluted water, untreated, suffered severely.

Removal of Snow.

It is evident that, owing to the shortage in municipal labour during the present crisis, there will be considerable difficulty in our towns and elsewhere should a heavy fall of snow occur. Hitherto the citizens have relied upon the local authorities to effect this for them, but now it will be necessary for every householder to bestir himself and execute the work either with his own hands or by those of his servants, as there will be no casual labour available as heretofore. Prior to 1891 the legal responsibility for the removal of snow from footways in the Metropolis rested upon the occupiers of the adjoining premises, and prose cutions for failure in the discharge of this duty were by no means uncommon. In that year,

however, the Public Health (London) Act became law, and the duty was cast upon the sanitary authorities of collecting and removing, "so far as is reasonably practicable," all street refuse, which by the definition in the statute includes snow. In the present state of the labour market it would be difficult to say that it is "reasonably practicable" for the sanitary authority to remove snow from all footways, and the question of what is to be done in the event of a fall is now under consideration in many metropolitan boroughs. In Kensington, for example, the borough council have been informed that under existing circumstances it will be impossible to secure the necessary manual labour for clearing snow from footways in the borough after a heavy fall; in fact, it is felt that some difficulty will be experienced in obtaining labour sufficient to deal even with the main thoroughfares. The recommendation to the council is that a notice should be circulated among the residents and displayed on street columns that in the event of the Metropolis being visited by any heavy falls of snow the council will be compelled to look for the assistance of householders in the direction of effecting the removal of the snow from the footways opposite their respective premises.

We understand, too, that similar action is being taken in Wandsworth and Hackney. In districts outside the Metropolis the matter can be arranged more simply, because of the power given by sec. 44 of the Public Health Act, 1875, to make by-laws, in certain circumstances, imposing the duty of removal on the occupiers of adjoining premises. But in the case of snow removal, as indeed in every kind of work, there is a best way of proceeding, and of this the average householder is all but completely ignorant. The following suggestions may therefore be of advantage to him. He is naturally only concerned with the footpath, and in clearing this he should be careful not to obstruct the channel or gutter of the carriageway, but keep the snow clear of the kerb, so as to leave a free run for the water when the snow melts. He will also find it easier to clear the snow from the footpath before the traffic has consolidated it. An ordinary coal shovel, or even the fire shovel, is a good tool for the purpose. A broom is sometimes of no use if the snow is hard, but in this case, if salt is sprinkled on the snow it will melt, and then become amenable to the broom. Would it not be well to issue some simple instructions of this kind in districts where it is proposed that the householder should be responsible for the work?

* * *

The Concrete Institute.

The Concrete Institute has been fortunate in securing for the second year in succession the services as president of Professor Henry Adams, for not only is that gentleman eminently qualified for the position, but the additional advantage is secured in avoiding a change in the midst of the present crisis in public affairs. The address which he delivered last week on the occasion of his re-election was confined entirely to matters which are strictly relevant to the objects of the institute. At the outset he referred to the reinforced concrete regulations which recently received official approval, and pointed with satisfaction to the fact that the whole of the council's recommendations were incorporated in the final draft. The war has naturally caused a great depression in the inception of new engineering schemes, but with the advent of peace there is bound to be a boom—at all events on the Continent. Reinforced concrete will then doubtless be used to an extent hitherto unknown. Its great strength and toughness were demonstrated by the destructive work of the Germans in their retreat from Soissons. There are two bridges at that town, one of metal and the other of reinforced concrete, and both were blown up. The destruction of the former was complete, while the latter, although, of course, it suffered very great damage, still crosses the river, and is even now being used with the aid of temporary gangways.

Perhaps the most interesting part of Professor Adams' address, however, was that in which he spoke of failures of concrete structures and their causes, with special reference to a paper read by Mr. R. S. Greenman before the American Society for Testing Materials. It has been well said that the man who never makes a mistake never makes anything at all, and the same is true of any profession which is not content to remain entirely conservative. The investigation of the causes of failures is therefore a most useful aid to progress. Mr. Greenman's experience is that by far the largest number of failures are due to poor workmanship, while in those cases where inferior materials are to blame, the aggregate offends in about four times as many cases as the cement. Assuming this statement to be correct, the principal lesson to be deduced from it is the vital necessity for thorough supervision of concrete work in every detail by properly trained expert foremen. Too often the work of mixing and placing concrete is still regarded as unskilled, and is left to the unaided intelligence of labourers. A greater mistake could hardly be made. In structures of any considerable importance, only men thoroughly accustomed to the work should be employed, and these should be under the most constant supervision. Only in this way can sound workmanship be insured, and the most prolific cause of failure be avoided. Professor Adams rightly criticised the epigram that "concrete is its own best inspector," which means that defects in workmanship or material will quickly reveal themselves. The object of inspection is to avoid the appearance of such defects after the work is completed, together with the legal and engineering difficulties with which they will inevitably be accompanied.

* * *

Sewage Disposal by Aëration.

On several occasions we have pointed out the desirability of making investigations into the possibilities of the activated sludge process when carried out on the continuous flow system. While we are waiting for this to be done here, our friends in America, recognising the great value of this process if it can be applied satisfactorily in a practical manner, have already commenced experiments, and in one case have been so far satisfied with the results that it has been decided to spend the sum of about £13,000 on an installation of much larger capacity as a further test of the process before adopting it for the whole of the sewage of the city. The results of the experiments and details of the proposed new works are given in a paper by Mr. T. Chalkley Hatton, chief engineer of the Milwaukee Sewerage Commission, which was read at a meeting of the American Society of Municipal Improvements recently. From the extracts from this paper which are printed on another page it will be seen that the process can be carried out on the continuous flow principle without difficulty, and we find that several important points which had already occurred to us are decided, at any rate provisionally. In the first place, it is stated that rectangular tanks will probably be the most suitable form for this process. Further, the importance of the depth of the tank is emphasised, and we shall hope to learn more on these points after the large installation has been in operation for some time. Again, it is definitely stated that the width of the tank in which the aëration takes place must not exceed 6 ft. to 8 ft. if the most economical disposition of the air is to be obtained. From this we gather that it is desirable that the

which leads the sewage should move forward from the inlet of the tank to the outlet, but we doubt whether this result can be secured in a tank 9 ft. deep, as we think it will be found that only the upper portion is actually displaced. In this connection we believe there is room for further investigations. The diagrams showing the estimated cost and quantity of air, and the total cost of the treatment by the activated sludge process for 50,000,000 gallons per day are extremely interesting, and are certainly the most useful and instructive we have seen up to the present, and we await with much interest the further information which will in due course be available from the operation of the larger plant now being installed. Meanwhile, all engineers engaged in sewage disposal work will be indebted to Mr. Hatton for taking the initiative in this work, and particularly for making the results available to all other engineers in the world.

* * *

Institution of Municipal Engineers.

On Saturday last the seventh annual general meeting of the Institution of Municipal Engineers took place, and the new president, Mr. Henry C. Adams, M.INST.C.E., delivered his inaugural address. Mr. Adams, who is a son of Professor Henry Adams, succeeds Mr. Matthews Jones, the city surveyor of Chester, at an anxious moment. The report of the council shows, however, that the institution has stood the searching test of the past twelve months remarkably well, and we have every confidence in its continued prosperity under the guidance of its new leader. In common with other professional societies and institutions a large number of members are serving their King and Country in various capacities on sea and land. It must not be forgotten, too, that the municipal engineer who is compelled to remain at home is bearing a greatly increased burden of service, not only by reason of depletion of staff, but also in many cases by a great increase of work owing to the establishment of camps in the district, or to the special use of roads for the purposes of military transport. At the beginning of his address, and before turning his attention to engineering matters, Mr. Adams dealt at some length with the important questions of security of tenure and professional education. Our own views on both of these subjects are very well known, and we are in entire agreement with Mr. Adams' main contentions. In dealing with education, Mr. Adams, while not underrating the value of practical experience, emphasised the importance in this day of specially and thoroughly scientific training. The opportunities now afforded by "modern" universities, colleges, and technical schools are so convenient and inexpensive, that the young municipal engineer who deliberately neglects them is seriously prejudicing his future. Above all, the attempt made by some authorities to force an engineer to take a pupil with the sole idea of eking out an inadequate salary should be stamped out as being dishonest in principle.

Engineering Questions.

The latter part of Mr. Adams' address contained some interesting observations on those branches of municipal engineering with which he is more closely identified at the present time—namely, sewerage, water supply, and structural work. In connection with the first-named topic, he referred to the issue during the past year of the Ninth and Final Reports of the Royal Commission on Sewage Disposal. He pointed out, however, that arduous as the labours of the commission have been, and useful as the reports have proved, they do not eliminate the need for the employment of skilled engineers or reduce the responsibility devolving upon them. In regard to water supply, we should like to emphasise the plea put forward for the combination of areas—and particularly of rural areas—in suitable cases. This, as was pointed out, can be done by the Local Government Board, under sec. 279 of the Public Health Act, 1875, upon joint application being made by the authorities concerned. Unfortunately, to quote Mr. Adams, neighbouring districts frequently have a strong disinclination to co-operate, unless it happens that both require a supply of water at the same time and cannot obtain it otherwise. A similar disinclination to co-operate exists in the case of adjoining parishes in the same district.

The last part of the address dealt with reinforced concrete. This material is not used in municipal engineering work in this country to anything like the extent that might have been expected. The principal reason is, no doubt, the unreasonably short period allowed by the Local Government Board for the repayment of loans. As Mr. Adams justly said, it would appear that in this respect the board have departed from their usual practice of fixing the loan period co-determinate with the probable useful life of the projected work, or the average life of work of a similar character, because it is well known that the actual life from numerous practical examples has already greatly exceeded the loan periods allowed; and it is surmised upon good and substantial evidence that its life is unlimited. Finally, in dealing with reinforced concrete in road construction the president called attention to a recent case in which an action was brought by the Gas Light and Coke Company to restrain the Woodford and Wanstead Urban District Councils from using wire fabric road reinforcement on the ground that its use would be a serious hindrance to the company in getting down to their mains. Experimental lengths were constructed by the gas company of reinforced concrete 6 in. thick and ordinary concrete 12 in. thick, upon which at a later date workmen were put to open through. It was found that the reinforced concrete was cut through in a shorter time than the thick bed of ordinary concrete, and the gas company thereupon withdrew the action.

Military Traffic and the Roads.—Mr. C. Colston, in presenting the report of the Roads and Bridges Committee at a recent meeting of Wilts County Council, said from the agenda they might imagine that the road staff had had a very easy time of it, but he spoke from experience, and he did not hesitate to say that during the past fifteen months the road staff had been subject to altogether exceptional stress, and for a long time past their hours of labour had been fourteen a day. They did not complain, and he did not complain on their behalf, but he thought that the council should be informed of such good and devoted service. The cause of this additional work had been due not so much to the actual presence of an enormous body of troops—men whom they most cordially welcomed and were proud to see in their midst—but to the fact that thousands of tons of material had been hauled over the roads in order to build the huts, making roads for the military. He admitted that damage had been done by the nation, and the nation had stepped forward to make that good, but many difficulties had to be faced by the office staff in connection with the matter. Though the Road Board found the money, they had to look to their own county surveyor and staff to evolve order out of chaos. It was no exaggeration to say that miles upon miles of their roads were literally destroyed; they could not be described as roads, but were simply pieces of mud and slush. They were at last seeing daylight. Prices were falling, and they were in a position to discharge men, and though enormous work yet remained to be done the progress was most marked. The roads were stronger than before, but whether they were stronger having regard to the immense increase in the mechanical traffic which passed over them, subjecting them to tremendous strain, he would not like to venture an opinion on.

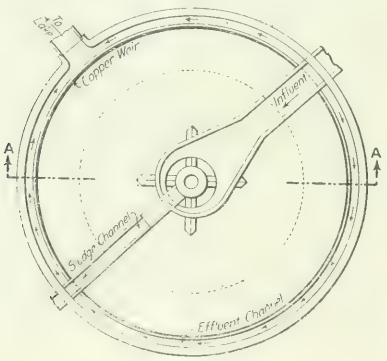
Activated Sludge Treatment.

AMERICAN CITY'S LARGE-SCALE INSTALLATION.

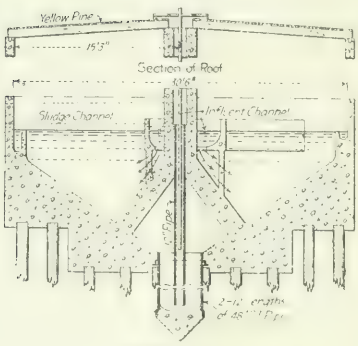
By T. CHALKLEY HATTON, Chief Engineer of the Milwaukee Sewage Commission.

[Basing a decision on the results of experimental work costing £13,000, the Milwaukee Sewerage Commission is building the world's pioneer large-scale plant for the treatment of sewage by the activated sludge process. The new works comprise eleven circular 30-ft. concrete tanks of the continuous flow type, designed to treat 1,600,000 gallons of sewage daily with a 4-hour period of aeration and a 25 per cent activated sludge content. A feature of the plant is the diffusion of air at the tank bottoms by porous quartz sand plates. The works which are being constructed for the purpose of trying out the process on a normal size unit, so that the city may be guided in the ultimate expenditure of £600,000 on its sewerage system, were described by Mr. T. Chalkley Hatton, chief engineer of the Milwaukee Sewerage Commission, at the convention of the American Society of Municipal Improvements, held in Dayton, Ohio, recently. The following extracts, reproduced from "Engineering Record," are from Mr. Hatton's Paper.]

The operation of experimental tanks, placed in operation last March, clearly demonstrated that it was possible to treat the sewage of Milwaukee by the activated sludge process on the fill-and-draw method, when the temperature of the sewage was 50 deg. Fahr., or more, at less cost than by any other process with which the commission had been experimenting, taking into consideration the character of effluent obtained. Having determined the availability of the fill-and-draw method, it was determined to try the continuous flow method. Activated sludge was obtained for seeding this tank partially from the Imhoff tank and from fresh sewage.



Plan.



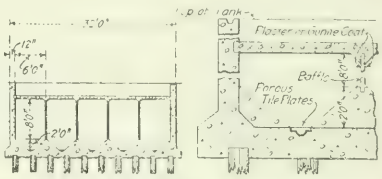
Section A A.

SEDIMENTATION TANK DETAILS.

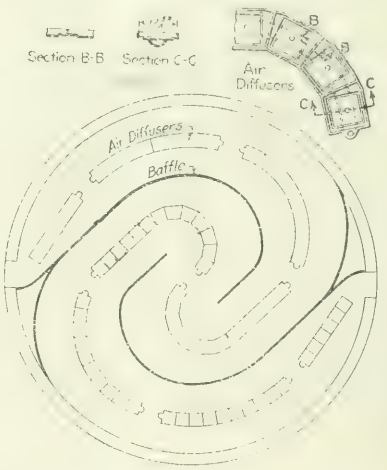
The Imhoff tank sludge, which is anaërobic, and which must be converted into aërobic sludge before activated sludge is produced, was run into the new tank; to this was added fresh sewage every eight or ten hours, and the mixture aërated by blowing air through it under about 5 lb. pressure. At the end of six or eight hours the air was turned off, sludge allowed to settle, the supernatant liquor drawn off, fresh sewage added to the capacity of the tank and the aëration repeated.

This process was continued until the tank contained about 30 per cent of its capacity of good activated sludge. It required about thirty-three days to seed this tank in the manner described, whereupon it was started upon the continuous flow method. This was begun during the first week in July of this year, and has been continued without material interruptions since.

From the beginning of the tests remarkable results were secured, according to Mr. Hatton. With a rough-screened sewage containing from 1,000,000 to 7,000,000 bacteria per cubic centimetre, 250 p.p.m. of suspended matter, 30 p.p.m. organic nitrogen, and 120 p.p.m. oxygen consumed, an effluent was produced containing a 99 per cent removal of bacteria



ARRANGEMENT OF BAFFLES AND AIR DIFFUSER PLATES.



Plan

BAFFLES DIVERT FLOW OVER AIR DIFFUSERS IN TANK BOTTOM.

and suspended matters, 12 to 14 p.p.m nitrates, stable after five days and clear as the lake water, leaving a sludge containing 5·45 per cent of ammonia, 1·34 per cent of available phosphoric acid, and 0·23 per cent of potash, worth as a fertiliser $9 a ton, based on dry weight.

This was accomplished with 1·77 cub. ft. of air per gallon of sewage treated, costing $4.43 per 1,000,000 gallons, based on air at $2.50 per 1,000,000 cub. ft. compressed to 5 lb. pressure, which is the guaranteed cost where large units are used, and includes all overhead charges and boiler-room labour, but not

outside plant or engine-room labour. Experiments now under way indicate that the volume of air can be very much reduced. In considering the cost of this process the character of effluent obtained must not be lost sight of. The effluent above described is of far higher standard than any yet obtained from any of the processes with which experiments have been conducted at the Milwaukee testing station, and much higher than is ordinarily required. If the standard is reduced the cost will be reduced in direct ratio.

In view of the foregoing record of results obtained by this process, either by the fill-and-flow or continuous flow method, it is not surprising that the Sewerage Commission felt warranted in expending what extent cannot be determined until a fair trial is made, and the contemplated plant may show that some artificial heat will have to be applied to some portion of the process during the extreme low temperature periods.

DESCRIPTION OF PLANT.

The plant consists of eleven circular reinforced concrete tanks 30 ft. inside diameter by 13 ft. maximum depth, supported upon a pile foundation, due to the instability of the soil. Tanks 1 to 6, inclusive, are the aërating tanks in which the sewage mixed with the activated sludge is aërated by means of air forced in under 5 lb. pressure. Tank 9 is the sedimentation tank, and tanks 10 and 11 are the

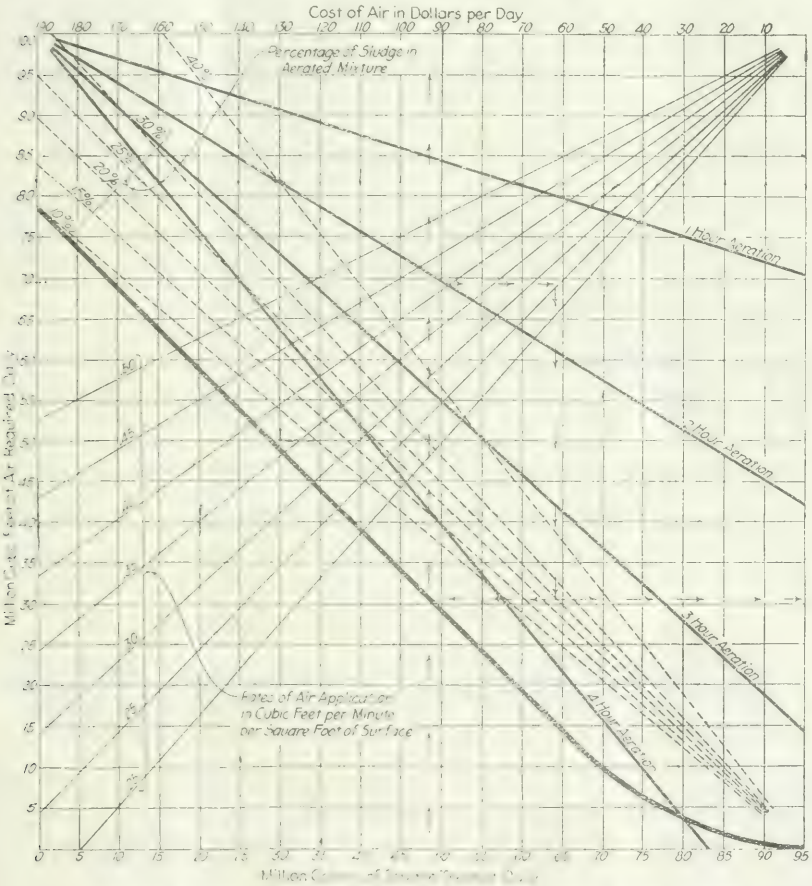

Cost of Air in Dollars per Day
Percentage of Sludge in Aerated Mixture
1 Hour Aeration
2 Hour Aeration
3 Hour Aeration
4 Hour Aeration
Rates of Air Application in Cubic Feet per Minute per Square Foot of Surface
Million Gallons Sewage Treated Daily

DIAGRAM I. COST AND QUANTITY OF AIR FOR ACTIVATED SLUDGE PROCESS.

NOTE.—The amount of air used per 1,000,000 gallons of sewage is based upon the use of a tank of 9 ft. average depth. The final cost of aëration is, however, nearly independent of the depth of tank if the rate of aëration per square foot of tank surface remains constant, as if the depth were doubled the volume of air per gallon of sewage would be halved, but its pressure doubled.

These arrows show the procedure for 50,000,000 gallons of sewage, two hours' aëration, 0.25 cub. ft. per 1,000,000 rate of air application, and 25 per cent of sludge.

Instructions.—Begin at the bottom of the diagram with the number of gallons of sewage treated daily. Run vertically to the selected period of aëration, then horizontally to the selected rate of air application, then vertically to the percentage of sludge, then horizontally to the heavy curve, and thence vertically to the cost in dollars per day. To find the amount of air in millions of cubic feet per day, run horizontally to the left instead of to the heavy curve.

$65,000 trying out the process on a large size unit, before adopting it as a plant which would ultimately cost in the neighbourhood of $3,000,000.

One of the principal reasons for building the large unit was to determine how much low temperatures of the winter would affect the process, what methods would have to be used to overcome this effect, and what they would cost. The foregoing results have all been obtained with sewages varying in temperatures from 50 to 70 deg. Fahr., whereas the winter sewages run down to 42 deg. Fahr. for short periods. It is well known that low temperatures seriously affect the efficiency of nitrifying organisms, but to

activated sludge tanks. The drawings show details of the aërating tanks with their curved baffles, the manner of sloping the bottom of the running-through channels so as to avoid the deposition of sludge, and the manner of placing the air diffusers. The sedimentation tank is the only tank to be roofed over. The roof is necessary to prevent ice forming about the edges of the circular weir, which would set up uneven currents. This tank has a radial flow, and is designed for a twenty-five-minute sedimentation period, at a 2,000,000-gallon rate.

The two sludge tanks are similar to the aërating tanks, except that they are each made into two sepa-

tate compartments by stop planks connecting the two ends of the baffle walls. Their pipes and diffusers are placed in the same number and manner as in the aërating tanks.

Wooden rectangular troughs are built part way around each tank to control the direction of the flow of liquor, and stop planks are arranged so that any one or series of tanks can be cut out. The sewage from 250,000 people, to which is added the sewage from the packing house district, passes out to the lake through a 20-ft. wide open channel alongside of the proposed plant.

In this channel a weir is constructed 20·35 ft. long, which maintains a depth of about 3 ft. of liquor for 40 ft. back of the weir. This is the grit chamber in which the heavier solids from the street washings are deposited, as the sewers connected with this large intercepting sewer are of the combined type. The weirs have been so arranged as to provide a flow through the plant to correspond with the fluctuations of flow through the main sewer, and the air applied to the sewage will be automatically regulated to correspond with this flow. Self-recording

used as a fertiliser. The method of dewatering has not yet been decided upon, but will probably be by means of the sludge press or vacuum wheel. The deep chambers connected with the settling tank and sludge tanks are for the purpose of dewatering the sludge as much as possible by weight, and thus avoiding the pumping of unnecessary liquor through the process.

It has been found by the experiments conducted that the success of the continuous flow method depends upon maintaining good activated sludge at all times in the tanks treating the fresh liquor. By aërating the sludge to a higher degree than the whole body of the liquor, air is saved because only 25 per cent of the entire mixture is thus given an additional aëration.

The plant as designed can treat 1,600,000 gallons of sewage per day with a four-hour period of aëration and with a 25 per cent activated sludge content. From present indications it will be able to treat the sewage satisfactorily, when the temperature is 50 deg. Fahr. or over, at a much higher rate; but this is yet to be determined on the large scale. In

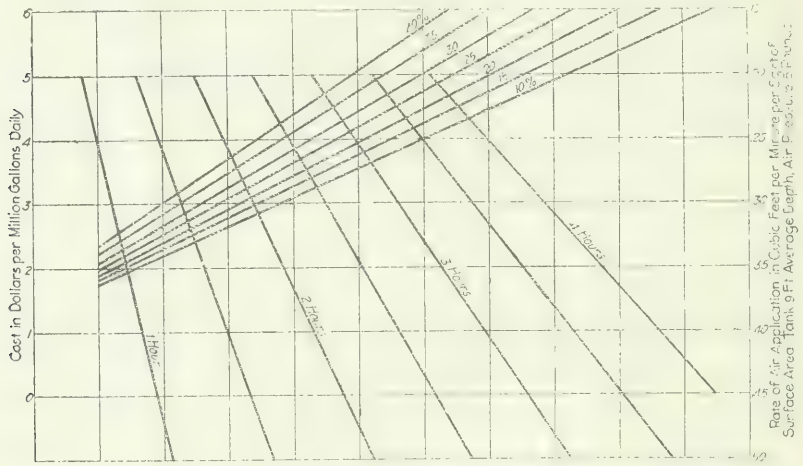


Diagram 2. Cost of Activated Sludge Treatment for 50,000,000 Gallons.

Note.—Costs as shown embrace all interest charges and operating costs, including boiler-room labour, but excluding engine-room and plant labour. Tankage is provided for 1½ times the average daily flow, and the sedimentation period is half-an-hour. Pumping of sludge is figured in as 30c. per 1,000,000 gallons of sludge pumped on the basis of 10c. per 1,000,000 gallons 1 ft. high.

Instructions.—Select the required rate of air application on vertical line to the extreme right. Run from this point horizontally to the left to the required period of aëration, then run vertically to the required percentage of sludge in the mixed liquor, and thence horizontally to the left for the cost in dollars per 1,000,000 gallons of sewage treated.

air meters will be installed to determine the volume and pressure of air used.

The sewage, after passing the plant weir, enters tank 1, where it comes into immediate contact with the air and the activated sludge, with which the tank has been originally seeded. It is designed to use 25 per cent of this activated sludge at first and to increase or diminish it as the operation shows necessary to get the most economical results.

Passing through tank 1 the liquor, mixed with the sludge, enters tank 2, when it is again aërated and further mixed with the sludge contained in that tank, and so continues until it passes, with the sludge mixed with it, into the centre channel of tank 9. Here the sludge settles out to the bottom of the tank, the clear liquor passing over the circumferential weir to the lake.

The sludge settles to a deep well built in the bottom of the settling tank, and is discharged by gravity into sludge tanks 10 or 11, where it is aërated for such a period as may be necessary to maintain the nitrogen cycle. From these sludge tanks the sludge passes to an 18-in. cast-iron pipe sunk vertically in the ground with its base about 28 ft. below the height of the liquid in the sludge tank, and from this pipe it is pumped by air into the fresh liquor trough, entering tank 1 with the raw sewage and again passing through the process.

That portion of the activated sludge in excess of what is necessary to maintain the proper percentage in the aërating tanks is pumped out of the sludge tanks from time to time and dewatered, and will be

order to overcome some of the effects of low temperature it is designed to pass the condensing water from the present sewage station adjacent to the new plant through coils of pipe hung to the inside perimeter of the two sludge tanks, inducing circulation by a circulating pump built in the condenser discharge line. This water is now discharged into the river at a temperature of about 100 deg. Fahr.

The power plant for producing the air necessary for operating the plant consists of two positive pressure rotary blowers, each having a capacity of 2,400 cub. ft. of free air space per minute compressed to 6 lb. pressure and belt driven from two alternating current variable speed motors each of 75 b.h.p. Only one unit will be required for operating the plant. Two are provided to avoid possible interruptions.

One of the questions which would immediately arise in the mind of the engineer is why were circular tanks designed in preference to rectangular. These tanks were designed before any results had been obtained from the continuous flow method, and Mr. Hatton felt there were only two processes available for satisfactorily treating the sewage of Milwaukee—the activated sludge process with continuous flow or fine screening, followed by Imhoff tank sedimentation, followed by chlorination. If the former process proved a failure the latter would have to be adopted. The tanks were therefore designed so that they could be used as the digestion chambers for an Imhoff tank installation by removing the sloping bottoms and baffle walls.

RECTANGULAR TANKS BEST.

It is quite possible that rectangular tanks will be found to fulfil the conditions required to obtain the process. One advantage is that the air diffusers can be placed across such a tank at right angles to the direction of flow, thus avoiding possible short circuiting of the liquor; another is the better convenience of placing the air piping system and avoiding [illegible] forms for construction. But whatever form of tank is adopted the width of the running-through channel should not exceed 6 ft. to 8 ft. to get the most economical disposition of the air.

Many experiments have been conducted with a view of determining the best form of air diffuser, and others are now being carried on. So far the Filtros plate seems to give the best result. This is a composition of quartz sand and some character of cement to bind it together. The sand is ground to a uniform coefficient to give any desired porosity, and, after adding the cement, is burned in a furnace. The plates come any size or shape desired, and at any thickness. In the Milwaukee plant a plate 12 in. square by 1½ in. thick is being used, and has a capacity for passing 2 cub. ft. of air per square foot at 2 in. water pressure. The porosity is 33·27 per cent by voids. This material is manufactured by the General Filtration Company, Inc., of Rochester, N.Y.

It has been found very important to maintain as far as possible an even diffusion of air throughout the body of the liquor—that is, every square foot of plate should contribute its share of free air. To this end orifices are provided to be set in the casting under each Filtros plate. Each orifice is designed to pass the required volume of air under a predetermined pressure.

COST.

Of course, one of the most important factors to be determined in treating sewage by the activated sludge process is the cost, and the writer presents herewith an estimate of the cost so far as it has been determined from the experiments so far conducted.

In considering this phase of the question it should be first realised that such effects upon cost as low temperatures might have has not been determined; that, with this exception, sufficient data have been secured to accurately determine how much air is required to treat the sewage and sludge to produce a certain standard of effluent from the Milwaukee sewage, and guarantees from well-known manufacturers of blowers, engines, turbines and motors have been secured as to the efficiency of the several apparatus they will undertake to furnish for the final treatment plant.

General dimensions of aërating, sludge and settling tanks have been determined with reasonable accuracy based upon the various periods of aëration and sludge content shown upon the diagrams. These diagrams have been prepared for determining the cost of treating a daily average of 50,000,000 gallons of sewage at Milwaukee, with coal worth 1 cent per 82,000 B.T.U., the price now being paid by the City Water Department; but from the diagrams the cost for other rates of flow can be determined.

It is clearly demonstrated, however, that the smaller the plant the higher the cost for treatment, due to the less efficiency in operating small-size blowers, and reciprocating engines and small motors, instead of large-size blowers, steam turbines or large motors. It may be that this cost can be considerably reduced by using oil or gas engines in driving the smaller units.

Diagram 1 shows the cost of producing the air per 1,000,000 gallons treated per day under varied conditions as to period of aëration, rate of air application per square foot of tank surface and percentage of activated sludge maintained in the tanks. This cost includes all boiler-room labour and all overhead charges, such as interest, sinking fund, and depreciation.

Diagram 2 includes the cost of the plant for treating the sewage, which cost includes all overhead charges, such as interest, sinking fund and depreciation. The only labour cost included is boiler-room labour, the engine-room and plant labour not being included for want of sufficient information.

These diagrams are based upon rectangular tanks holding an average depth of 9 ft. of liquor, the depth which has so far seemed most applicable to the Milwaukee situation.

In Milwaukee the most satisfactory results have been obtained by using 0·25 cub. ft. of air per minute per square foot of tank surface, a period of four hours' aëration with a sludge content of 25 per cent. By referring to diagram 2 it will be seen that this treatment will cost $5.30 per 1,000,000 gallons treated, exclusive of engine-room and plant labour and the disposal of the sludge. If a lower standard of effluent is required, and a three-hour period of aëration only is required with 20 per cent sludge content and the same rate of air supply, the cost will be seen to be $3.95 per 1,000,000 gallons treated.

Mr. Hatton believes he is warranted in the statement that the above costs are much below the cost of producing an equal standard of effluent from any other process of sewage treatment applicable to a large United States municipality. It seems quite within the bounds of reason to anticipate that there will be sufficient recoverable value in the sludge to pay for its final disposition at least, so that the cost of this portion of the process need not be taken into consideration when comparing it with the cost of treating sewage by any other process.

THE INSTITUTE OF ARBITRATORS.

We have received a copy of the first number of the quarterly journal of this body, which was founded in March last at the instance of members of those professions whose services are usually invoked for the purpose of acting as arbitrators in commercial matters, in references under partnership agreements, and building and other trade contracts, with a view to their corporate association, both for their own benefit and in the interest of the general public. The first president of the new body is Lord Headley, and the vice-president Prof. Henry Adams, and among the members of council are Mr. E. C. P. Monson, president of the Society of Architects, Mr. Norman Scorgie, president of the Society of Engineers, Mr. T. E. Bare, and Mr. Walter Lawrance, past-presidents of the Quantity Surveyors' Association, Mr. Horace Boot, past-president of the Institution of Municipal Engineers, Mr. H. D. Searles-Wood, past-chairman of the Royal Sanitary Institute, and Mr. Isaac Shone.

The institute is open for the enrolment of members possessing the necessary training and experience in the various professions of consulting, civil, mechanical, electrical and other engineers, architects, surveyors, accountants, and other similar professional bodies.

The minimum age for admission to membership has been fixed at twenty-one in the case of associates and thirty for admission to the degree of Fellow of the Institute.

Further particulars may be obtained from the secretary, Mr. H. C. Emery, 32 Old Jewry, E.C.

Society of Engineers. At a meeting of this body to be held at Caxton Hall, Westminster, on Monday next, Mr. Alphonse Stelger, M.INST.C.E., will read a paper entitled "The Modern Development of Water Power." The chair will be taken at 7.30 p.m.

Boots' Diaries for 1916.—With their usual enterprise, Messrs. Boots Pure Drug Company, Limited, of Nottingham, issue some excellent diaries for the coming year. Especially noteworthy is the "Scribbling Diary," which costs only 6d. It bears the announcement that it is "superior to those usually sold at 1s.," and in our opinion the claim is justified. It is really in these days of costly printing labour and dear paper wonderful value for the money. It is just the thing for the business-man's desk.

Smithfield Club Show Exhibits.—The exhibits of Messrs. Marshall, Sons & Co., Limited, Gainsborough, at the Royal Agricultural Hall next week, will comprise three oil engines, a portable steam engine, and a thrashing machine. The oil engines (one each 6 b.h.p. and 25 b.h.p. stationary type, and one 16 b.h.p. portable type) have been expressly designed to meet the general power requirements of farm and estate, and the firm's intimate knowledge of such requirements is based on over half-a-century's experience with agricultural machinery. The 6 n.h.p. single-cylinder portable steam engine represents the firm's well-established practice in the construction of engines of this class. The engine is suitable for a continuous working pressure of 120 lb. per square inch, and capable of developing 14·2 effective horse power as its economical load, and 21·5 effective horse power as its maximum load.

Institution of Municipal Engineers.

ANNUAL GENERAL MEETING IN LONDON.

The second annual general meeting of the Institution of Municipal Engineers was held on Saturday last at its Council Chambers, Southampton-row, London, under the chairmanship (in the first instance) of the retiring president, Mr. W. H. Matthews Jones, city engineer and surveyor, Chester. The attendance included the following: Messrs. Henry C. Adams, president, John Bailey (Spalding), F. S. Cutler (Deptford), E. A. Stickland (Windsor), W. Louis Carr (Ruislip-Northwood), Arthur Palmer (Greenwich), W. Wallin (Newcastle), G. Symon (Blaydon), E. Plummer Davies (Tisbury), T. Mundy (Woolwich), Horace Boot (London), G. A. Penwill (Peterborough), S. R. Drake (Leatherhead), E. Whitwell (Abersychan), J. C. Jenkins (Abersychan), H. C. H. Shenton (London), A. R. Bleazard (Clitheroe), and B. Wyand, secretary of the institution. A number of visitors also were present.

The secretary read the minutes of the last annual general meeting, which were duly confirmed.

The annual report of the council, which was taken as read, was in the following terms:

ANNUAL REPORT OF COUNCIL.

The report states that on June 30, 1914, the roll of the Institution was 895, consisting of 704 members, 121 associate members, and 67 students. On June 30, 1915, the roll was 842, consisting of 672 members, 127 associate-members, and 43 students. During the year 17 members, 15 associate-members, and 3 students were elected, while 6 associate-members were transferred to membership, and 7 students transferred to associate-membership. The losses resulting from death, resignation, erasure by change of appointment and other causes amount to 85 members, 13 associate-members and 20 students.

FINANCES.

The council are pleased to be able to report again an excess of income over expenditure on the year's working, amounting in this instance to £47 2s. 3d., and making an accumulated balance of £439 6s. 9d., notwithstanding that during the year £150 has been laid aside as a provision against "irrecoverables." Features of a satisfactory nature are the reduction of current liabilities by £46 10s. 11d., the increase of the accumulated balance by £47 2s. 3d., and the increase by £10 16s. 9d. of income over expenditure in the year's working. The reserve against "irrecoverables" has been increased.

MEETINGS.

One general meeting, thirteen council meetings, and thirteen district meetings were held during the financial year.

PREMIUMS FOR PAPERS.

The premiums for the year 1914-15 for papers read before meetings of the Institution have been awarded as follows: President's premium (presented by Mr. W. Matthews Jones) to Mr. Edward Whitwell (vice-president), for his paper, "Housing of the Working Classes: A Few Suggestions;" Institution premium to Mr. G. Belson Chilvers, for his paper, "A Plea for the Better Remuneration of Municipal Surveyors and Inspectors of Nuisances in Small Urban and Rural Districts."

MUTUAL AID AND DEFENCE FUND.

This fund is being satisfactorily worked, the amount standing to its credit at the end of the financial year (June 30th) being £69 13s. 2d. A committee, consisting of Messrs. F. Cutler, A. Winter Gray, T. Mundy, and John Taylor, was appointed to consider and report upon the administration of the fund. One application was made for assistance from the fund, but the council decided, after very careful consideration, that the case was not one which fell within the purpose for which the fund was created.

PUBLIC HEALTH ACTS (BUILDING BY-LAWS) AMENDMENT BILL.

This Bill also received the careful consideration of the council and of the General Purposes Committee, and at the meeting held on November 25th the following resolution—a copy of which was sent to the Local Government Board—was unanimously passed: "That the council of the Institution of Municipal Engineers view with concern the proposed introduction of undue and unnecessary elasticity into the operation of building by-laws, and are in the strongest opposition to the Public Health Acts (Building By-laws) Amendment Bill. The erection of buildings in rural districts with any kind of material, and the possible extension of this concession to boroughs and urban districts, will in effect operate to the detriment of the districts affected. The Memorandum to the Bill says: 'Above ground a man will be free to build as he likes, so long as he does nothing contrary to purposes of health,' and it is felt that these statements are in direct contradiction the one to the other. The only good point in the Bill is the discouragement of the crowding together of cottages, but this is provided for in existing Acts. The council foresee that if the Bill becomes law, the important and very necessary work of the building inspector in rural districts will practically cease."

Mr. T. MUNDY (hon. treasurer), in moving the adoption of the report, said it might be inferred from its contents with regard to membership that the institution was not in such a flourishing condition as could be expected, especially as they showed 896 members in 1914, compared with 842 in 1915. It must, however, be borne in mind that the council undertook a sort of weeding out every year of what perhaps might be termed undesirables; and he thought that in this respect they were more stringent than any other kindred society. They did not intend to carry deadheads, and after the sorting-out process they were left with a body of real live members. When he used the term "undesirables" he alluded, of course, to financial undesirables, who did not pay their subscriptions. With regard to the balance-sheet, he thought it was fairly satisfactory. They could, of course, do with more money, but what they had they could get on with fairly well. As to the Defence Fund, the committee were considering the question of its administration, and they hoped very shortly to submit a full report on the subject and to have the fund in full working order. The report was not perhaps so long this year as in the past, a fact that was possibly due to the times in which we were living. The activities of the institution could not be so great as in former years, but they had no doubt that when the war was over they could go ahead as before, and make greater progress than ever.

Mr. F. CUTLER (Deptford) seconded the motion, and said he would like to amplify the remarks of Mr. Mundy with respect to the financial position. He would not have been surprised, owing to the national crisis we were going through, if they had been in a position somewhat the reverse of desirable at the end of the financial year. It was gratifying to know in the circumstances that they were in a satisfactory position, making allowance for bad times, and also that they had a good sum in hand. They were looking forward with confidence to see the institution carry on its work on a sound financial basis.

Mr. HORACE BOOT (Tunbridge Wells and Westminster) said they would remember that a short time ago it was proposed by a certain member of the council and, he thought, put to the ballot, that something should be done to increase the size of the institution, and make it more useful and stronger financially. With this end in view it was proposed to form another class of members, to enable gentlemen who were more or less outside the profession of municipal engineering, but who were of the utmost value to municipal engineers with regard to their work, and, in fact, associated with them in the general sense, to be accepted for membership as a separate class of members. As the president of the institution at that time, he felt it somewhat difficult to advise the institution to adopt the proposition, but he might say he felt strongly with regard to the matter, and it was with very great regret that he found the whole question was eventually borne down by the fraction of a vote. Now he was in a position to voice why he thought it would be a valuable suggestion for the new president to take up. The value of the institution depended largely, unfortunately, upon its finances. He did not suggest that its finances were in any way impaired, or that they were in a dangerous position. As a matter of fact they were in a more healthy position to-day than since the start, and he thought great credit for this was

due to the Finance Committee, who had worked so assiduously on behalf of the institution. The members would agree with him that if they were to be a powerful institution, a power in the land to aid the profession generally, they must increase their numbers, and by increasing their numbers advance the financial stability of the institution. The suggestion put forward was that there should be another class of members who, it was thought, could be accepted with the assurance that they would do good to the institution. The first thing they considered when going into such a subject as this was—had it been done before? It would be found that all the leading institutions admitted so-called outsiders to their membership. There was only one, the Incorporated Electrical Association, which strictly confined its membership to engineers of boroughs. That association was established more for a distinct purpose than the Institution of Municipal Engineers—it assimilated more to the form of a trades union—but even they went outside their province and admitted two members of every Electricity Committee on all town councils. These gentlemen were sent invitations, and actually were members of the association. The Institution of Municipal Engineers extended their membership to nobody except engineers and assistants. He did not suggest they should make all town clerks, borough accountants, and other municipal officers members of the institution, but he thought they ought to have a class of members connected with municipal engineers and surveyors, and he ventured to think it would be an eminently healthy thing for the finances of the institution. Again, he was thinking why not extend membership to municipal engineers throughout the whole world? Not to the Colonies only, but to France, Italy, and other countries, with the exception, of course, of engineers of enemy countries. He thought they should do everything in their power to cement the Dominions and other countries by fellowship, and he threw out the suggestion to the president-elect that he might give his careful thought and guidance to this subject during the coming year.

The report and balance-sheet were then adopted.

THE COUNCIL, 1915-16.

The result of the ballot for the new council was declared as follows:

President: Henry C. Adams, M.INST.C.E., M.I.MECH.E., F.R.SAN.I., consulting municipal engineer, 60 Queen Victoria-street, E.C.

Vice-presidents: A. R. Bleazard, borough engineer, Clitheroe; Arthur Bowes, ASSOC.M.INST.C.E., surveyor, Newton-in-Makerfield Urban District Council; H. J. Farmer, borough surveyor, Christchurch; William Finch, county surveyor and bridgemaster, Cumberland; H. C. H. Shenton, consulting engineer, 28 Victoria-street, S.W.; William Wallin, consulting municipal engineer, Newcastle-on-Tyne; Edward Whitwell, F.I.S.E., M.S.A., engineer and surveyor, Abersychan Urban District Council.

Honorary Treasurer: Thos. Mundy, deputy borough engineer, Woolwich.

Ordinary Members: John Bailey, surveyor, Spalding Urban District Council; G. Belson Chilvers, surveyor, Oundle Urban District Council; F. S. Cutler, deputy borough surveyor, Deptford, S.E.; E. Plummer Davies, engineer and surveyor, Tisbury Rural District Council; John Davison, borough surveyor, Morpeth; Frank E. Ennals, surveyor, Billericay Rural District Council; Douglas C. Fidler, engineer and surveyor, Hayes Urban District Council; Ernest W. Hearn, borough engineer and waterworks engineer, Chard; R. W. Jones, county surveyor, Carmarthen (Western); H. W. Marsden, borough surveyor, Richmond, Yorks; John T. Pegge, city surveyor, Durham; Frank A. Pratley, engineer and surveyor, Epsom Rural District Council; John T. Shield, deputy borough and water engineer, Blackburn; George Symon, surveyor, Blaydon-on-Tyne Urban District Council; John Taylor, sanitary surveyor, Uckfield Rural District Council; David Thomas, engineer and surveyor, Ammanford Urban District Council; W. T. Unwin, town and district surveyor and architect, March Urban District Council; C. Owen Baines, water engineer and surveyor, Paignton Urban District Council; Alfred H. Carrell, county road surveyor, Leicestershire County Council; W. J. Grant, surveyor, Romford Rural District Council; John R. Mead, borough engineer and surveyor, Ipswich; J. Hedley Mole, surveyor, Chester-le-Street Rural District Council; Harold Pickering, surveyor, Luton Rural District Council; G. Simcox, engineer and surveyor, South Mimms Rural District Council; A. Harford Stevens, engineer, Blaby Rural District Council; Walter Louis Carr, engineer and surveyor, Ruislip-Northwood Urban District Council; William Finch, county surveyor and bridgemaster, Cumberland; Henry Hulse, borough surveyor and engineer, Droitwich; Frank Latham, M.INST.C.E.I., borough engineer and surveyor, Penzance; Colin H. Macfarlane, assistant superintendent, Glasgow Corporation; Charles F. Mayfield, borough surveyor, Godmanchester; Ernest Albert Stickland, ASSOC.M. INST.C.E., borough surveyor, Windsor.

Past-presidents: Frank Latham, M.INST.C.E.I., borough engineer and surveyor, Penzance; Horace Boot, M.I.MECH.E., M.I.E.E., consulting engineer, Horace Boot & Partners, 7 Victoria-street, London, S.W.; W. H. Matthews Jones, city engineer and surveyor, Chester.

THANKS TO THE SCRUTINEERS.

On the motion of the chairman, seconded by the president-elect, a vote of thanks was passed to Messrs. Palmer and Jennings, scrutineers, for their services.

RETIRING PRESIDENT'S ADDRESS.

MR. MATTHEWS JONES then delivered his valedictory address as follows: When taking the chair at your annual meeting last year I expressed a hope that the war which was then in progress would, before the end of my year of office, have ceased; but, unfortunately, such is not the case. I feel quite sure therefore that, under the circumstances, the institution has well kept its place with regard to other institutions, and that, generally speaking, we should congratulate ourselves on the state of our affairs. From the accounts it will be seen that we have a balance in hand, and although there is a large deficit in the way of arrears of subscriptions, these would not have been so great if it had not been for the war, and I think that all other similar institutions, more or less, are suffering from the same cause and in the same way. We have during the year enrolled many new members and associate members, and every application has been very carefully considered before the applicants have been elected to the institution. One feels proud to think of the number of members of our institution who are now serving H.M. Government in one way or another, and yet it is with deep regret that we hear of the death of some of our members who have been fighting in foreign countries, and who have been killed by the enemy; but it must be a great consolation to their relations and friends, and the institution, to know that these men have died fighting in a just cause. During my year of office I have attended meetings and visited the following towns—viz.: Newcastle-on-Tyne, Hartlepool, Newark, Salford, Manchester, and Dunstable, and during these visits I have received from the various district secretaries and members the greatest courtesy, and such visits have been exceedingly interesting and enjoyable. I cannot help but refer to the visit which was paid to Hartlepool, and to the way in which the surveyor (Mr. Horsley) received us and took us round, showing us everything that was worth seeing in connection with the bombardment of Hartlepool by the German Fleet, and I feel sure that such treatment of a town by the enemy would make any young man that had seen it wish himself in khaki so that he could go and retaliate. I take this opportunity of thanking the District secretaries and members generally, as well as the mayors and members of the various councils concerned for the way I have been received at each of the places I have visited. There have been many matters of importance before the council, as you will see from the annual report, all of which have received the greatest consideration from the members of the council. With reference to the papers which have been submitted by members to the institution, I should like to say that the premiums have been awarded this year to Mr. Whitwell for his excellent paper on housing, and to Mr. G. B. Chilvers for his interesting paper entitled, "Better Remuneration for Municipal Surveyors, &c." I should like to say here that the institution would be glad to receive more papers than we do from our members, for, generally speaking, there is always a great scarcity of such papers, and papers written on such subjects as roads, sewers, drainage inspections and tests, concrete constructions, tramways, or anything in the way of housing, town planning, &c., would be of help, as these questions are always being considered by surveyors, and always prove of great interest, for no two schemes are identical. Although there may be a great deal of repeti-

tion in such papers from time to time, there are always new points raised which cause food for thought, and I would like to impress upon members to do something in this way, and to try and gain the premiums which are offered. I now wish to take this opportunity of thanking the members of the council and the various officials of the institution for their exceeding great kindness and forbearance to me during the past year, and I should like to put on record my great and deep appreciation of the kindness I have received on all occasions from our secretary, Mr. Wyand, and although we may not have seen eye to eye on every occasion, he has never failed to treat me with the greatest courtesy. The time has now arrived for me to hand over the chair to our new president, Mr. Henry Charles Adams, but before doing so I should like to give you, very briefly, a short history of Mr. Adams' career. Mr. Adams is a member of the Institution of Civil Engineers, member of the Institution of Mechanical Engineers, member of the Institution of Water Engineers, Fellow of the Royal Sanitary Institute, Fellow and vice-president of the Society of Engineers, and he is a member of the board of examiners of several engineering societies, and has given several special lectures at the Royal Sanitary Institute on "Sewerage and Water Supply," while for some years past he has been lecturer on higher building construction to the Watford technical classes. He is the eldest son of Prof. Henry Adams, who is an engineer, and who is known more or less in every part of this country, as well as abroad. He is a grandson of Mr. John Henry Adams, the resident engineer on the North London Railway, and a great-grandson of Mr. John Samuel Adams, engineer of the East and West India Docks. I have perhaps gone back in history rather a long way, but it is with the intention of showing that our new president is an engineer "through and through," and comes of a family of very noted people in the "engineering world." Mr. Adams, as a young man, was articled to his father (Prof. Adams), one of the best things that can happen to a man when starting his career, for if the majority of fathers treat their sons like my father treated me, then I know that one's nose has to be continually kept to the grindstone. Mr. Adams obtained prizes in civil engineering and surveying at the City of London College, and has been through the mechanical course at the Crystal Palace School of Practical Engineering, and he afterwards filled several responsible posts in order to gain practical experience. He was for a time engaged as locum tenens for the Professor of Engineering at Hollesley Bay Colonial College, where, at rather a young age, he found himself instructing students to the number of about 120, many of whom were very much older than himself. Mr. Adams has spent a great deal of time and labour in the designing of heavy structural steelwork for many large breweries and other places, and was appointed some years ago to design a storage reservoir and works of water supply for the Salvation Army Colony at Hadley, in Essex. After this, he had in succession many appointments under municipal authorities, including, among others, that of chief assistant of the Kings Norton Urban District Council, the Stratford-on-Avon Rural District Council, the Evesham Rural District Council, and the Pebworth Rural District Council, in all of which positions his time was chiefly employed in the carrying out of several new works of sewerage, sewage disposal and water supply, and he then finished up as senior engineering assistant to the Birmingham Corporation. In this latter position he was responsible for the carrying out of a large part of the reconstruction of the main drainage of Birmingham and other sewer works, in addition to extensive river improvement works, including retaining walls and bridges. Before starting in practice on his own account he spent a period of his life as chief engineer and managing assistant to a firm of consulting engineers in private practice, and was responsible for the preparation of several large schemes of sewerage, water supply, and tramways, to the value of something like £400,000. Our new president has for the last seven years or so been in partnership with his father, Prof. Henry Adams, and while in such practice has acted as consulting engineer to many municipal authorities in all parts of the country, and his principal work has been in connection with schemes of sewerage, water supply, and also on questions of structural design, including bridges, structural steelwork, the stability of buildings, as well as reinforced concrete erections. Mr. Adams is frequently called upon to act as an expert witness before Parliamentary Committees and in the High Courts, and his firm have recently been retained by the War Office to design and supervise the construction of extensive permanent sewage disposal works. Mr. Adams is a well-known author, and regularly contributes most interesting articles to the technical press. He is the author of the book "The Sewerage of Sea Coast Towns," and is also responsible for another book, entitled "Waterworks for Urban and Rural Districts," the publication of which has been delayed owing to the war. He has presented many papers to the professional societies, including an exhaustive one on the question of "Railless Traction," and he has received a Miller Prize from the Institution of Civil Engineers, as well as a Nursery Premium from the Society of Engineers. From the foregoing remarks it will therefore be seen that our new president has qualifications second to none for the position he is taking up to-day. Those of you who know him personally will agree with me that it would be difficult to find a gentleman more capable of fulfilling the duties that will be put upon him as president of this institution. He is an engineer in every sense of the word, and I feel confident that he will add lustre and dignity to the office which he is about to take, and will fulfil the duties thrust upon him with absolute credit to himself and honour to the institution. Personally, I offer Mr. Adams my very hearty congratulations on his having accepted the position of president of this institution. I sincerely trust that he will have health and strength during the coming year to continue the arduous work of the institution, and I can assure him that every member of the council and every member of the institution wish him success, and will do everything possible in their power to help him. I now have much pleasure in asking Mr. Adams to occupy the chair in my place.

Mr. HENRY C. ADAMS, the new president, thanked the members for the cordial response they had made to the speech of Mr. Matthews Jones. For the moment he felt quite overburdened with the eulogy that gentleman had pronounced upon what he had done, what he ought to do, and what it was to be hoped he would do. He was quite sure that during his term of office he would do his best to promote the interests of the institution.

THANKS TO THE RETIRING PRESIDENT.

Mr. E. PLUMMER DAVIES (Tisbury) proposed a hearty and sincere vote of thanks to the retiring president for the excellent way in which he had discharged the onerous duties of the office during the past twelve months. In that period, he said, they had been passing through a crisis which had no parallel in the United Kingdom or the world, and which had made the performance of his duties very difficult. They had heard how many meetings Mr. Matthews Jones had attended, and the number of towns he had visited during the year showed very clearly the amount of work he was prepared to do for the advancement of the institution of which he was the head. It was thought that the election of Mr. Matthews Jones would be helpful for the institution, because a president living so far from London, it was felt, would tend to make the institution more widely known. He thought the ancient city of Chester had reason to be proud that they had as their engineer and surveyor a gentleman who had been so honoured, and now he was retiring from the chair, he (Mr. Davies) felt greatly pleased with the splendid way in which he introduced the president-elect, and outlined the qualities embodied in that gentleman. To do those things in the way Mr. Jones had done augured well for the future of the institution. He (Mr. Davies) paid a visit to Chester some twenty-five years ago, and was delighted with the picturesque quaintness of the city. He little thought then it would fall to his lot to move a vote of thanks to the engineer of that ancient historic city as the retiring president of the Institution of Municipal Engineers—an institution that had been established with the object of welding the municipal engineers of the country in a more practical and beneficent form than any other institution as far as he was able to discern.

Mr. E. WHITWELL (Abersychan) observed that he had pleasure in endorsing all that had been said by the mover of the proposition. As one who had sat under the presidency of Mr. Matthews Jones during his year of office, he could say that that gentleman had always treated him more like a brother than anything else; certainly he had not been the austere chairman whose acquaintance they sometimes made.

He (Mr. Whitwell) knew the city of Chester and the great work Mr. Matthews Jones had put in there, and he was sure that city had reason to be proud of their engineer, as the members of that institution were proud of the way in which he had filled the presidency during the past year.

Mr. W. H. MATTHEWS JONES, in reply, said he felt he had not done as much as he ought to have done during his year of office. He could assure them, however, that he would continue to take a keen interest in the welfare of the institution, and do everything possible further to advance its prosperity.

VOTE OF THANKS TO THE DISTRICT CHAIRMEN AND HON. SECRETARIES.

Mr. ARTHUR PALMER proposed a vote of thanks to the chairmen and hon. secretaries of the District Committees, and remarked that the work done by those gentlemen had been undoubtedly rendered more arduous owing to the war.

Mr. G. A. PENWILL (Peterborough) seconded the proposition, which was agreed to.

Mr. W. WALLIN (Newcastle), in reply, testified that the work of the council had been gone into thoroughly during the past year. As regarded those who had been described as undesirable members, he would rather describe them as members who would not pay their subscriptions. Some members used the institution as a stepping-stone, and when they had got to what they perhaps considered a little above it they left it, not altogether nicely, as they did not pay their subscriptions. Personally, he thought the institution was better without them. He would advise gentlemen not to get swelled head. The engineer who got swelled head was no use. It was necessary to keep level-headed, because they had to meet all classes of men, and it was desirable to treat every man as a human being—that was to say, in the same way in which they expected they should be treated by others. The member who would not pay his subscription and accept the responsibilities of the institution was no use to them. There was every possibility, with better financial support, of the District Committees doing even better work than they had done; but it was essential that the committees should always be seeking to extend the influence of the institution by increasing the number of their meetings. In the North they had been proud of their meetings; but, owing to the crisis, things had not been the same as before. A large amount of useful work was done by district secretaries, who, it should be remembered, were not able to pay expenses out of their own pockets in order to go over the district. They wished to see the District Committees bound together in common action, for it was only by work like theirs that the institution could be maintained as one whole body with the centre in London.

The proceedings were then adjourned for lunch.

On the resumption of business, following the announcement of the receipt of letters of regret for non-attendance from Messrs. H. H. Law (Local Government Board), P. C. Cowan (Local Government Board for Ireland), H. Percy Boulnois (Westminster), and Major A. J. Martin (Westminster), Mr. Henry Adams proceeded to read his

PRESIDENTIAL ADDRESS.

Mr. ADAMS said: In accepting the office of president, which is the highest honour it is in the power of the Institution to confer on any of its members, I must first express to my colleagues on the council, with whom I have worked so long and so happily, my sincere thanks for the kind expressions of goodwill and appreciation with which my nomination was proposed and received; and to the other members I tender my thanks for their cordial endorsement of such nomination, which has resulted in my being placed in this chair, and enables me to assume the duties thereof with confidence that I shall have the support and co-operation of every member of the Institution. It has not been customary to select our president upon any consideration of seniority, and the dignity has hitherto been conferred on him whom it was considered could best serve the interests of the Institution at the time. Although, personally, I would fain have remained less prominent, I could not resist the strong and persistent representations made to me to accept the office; nevertheless, I am deeply sensible of the responsibility thrust upon me, and can assure you that no efforts of mine will be wanting to promote the welfare of the Institution and to make the ensuing year at least as successful as those that have passed.

It is unnecessary for me to reiterate the numerous activities of the Institution during the preceding session; the principal matters are set forth in the annual report of the council. Having regard to the strenuous and difficult conditions under which we, in common with all other people, have been labouring, the results are extremely gratifying. There has been a considerable falling off in the number of meetings held, but this is only natural, as very few of our members have time now to prepare papers or arrange visits. In the ordinary way a larger number of meetings are held than is perhaps appreciated by individual members, and probably it would be accurate to say that on an average there is at least one meeting in connection with the Institution held each week throughout the year in one part or another of the country. Many of these are arranged and carried through by the District Committees, and frequently are not announced or reported in the technical press, or even communicated to members in general. While modesty has its advantages, and is a natural attribute of engineers, I think a little more publicity regarding our work would be beneficial in many ways; but to secure this end it will be necessary to have the co-operation of the honorary district secretaries, and thus add to their labours, which are already by no means light. The Institution is under a debt of gratitude to the several honorary district secretaries, whose untiring efforts in working for the Institution have contributed in no mean degree to placing it in the high position it occupies to-day.

Our motto might well be "Decentralisation and Representation." The system of District Committees, which was first devised by this Institution, has worked exceedingly well on the whole. A very wide measure of Home Rule obtains, but the work is well co-ordinated with that of headquarters. We do not, of course, claim perfection, because there are so many factors to take into account that the problem is far from simple, but any difficulty that may occur has only to be made known for it to receive the most careful consideration with a view to its removal.

WAR SERVICE.

The Institution has every reason to be gratified by the manner in which the members are serving the country in this time of stress. As many as 10 per cent, including students, have actually joined His Majesty's Forces in various capacities on sea or land. Some of these are still in training, but others are on active service, and, alas! a few have fallen. The names of all are being inscribed on the Roll of Honour which is being prepared for preservation in the archives of the Institution. Those who have passed hence have died a glorious death fighting for our ancient heritage of freedom, and their memory will be enshrined in the hearts of their colleagues, who are themselves compelled to remain behind to carry on the public health services of the country, but who have sent their nearest and dearest to represent them in the field. Our sympathy goes out to the relatives of those who have given their lives.

Much that has been done by those left behind here will never be told. In some cases, with depleted staffs and scarcity of workmen, they have had to improvise means of supplying water, disposing of the sewage, and dealing with the refuse from populations increased by the creation of military camps to as many as five or six times the normal. In other towns, not so situated, our members have devoted such little spare time as they could find to rendering professional assistance to the War Office without remuneration. At the same time, practically all normal routine work has had to be carried on. While deploring the circumstances, it must be recognised that the knowledge gained will be of very considerable benefit in after years, and it is to be hoped that when peace reigns again our members will allow others to profit by their experience, and will describe the numerous emergency and other engineering works carried out by them, in a form which will be suitable for presentation at meetings of our Institution.

SECURITY OF TENURE.

The council has from time to time given considerable attention to the question of security of tenure, which is a matter of paramount importance to the State as well as to our individual members. When rightly conceived and carried out, the activities of a municipal engineer are directed solely to the benefit of the health and welfare of those within the district he serves, and therefore he should be able to rely at all times upon the cordial support of all concerned. Unfortunately, in the present imperfect state of human nature

there are many people who place their own interests, or what they conceive to be their interests, before the interests of the community, and the discharge of his duties must inevitably bring the municipal engineer into conflict with such people. This in itself is not a serious matter, as the greater part of an engineer's life is spent in surmounting difficulties, and he usually possesses considerable tact and patience; indeed, without such qualities it is improbable that he could secure or retain an official appointment. The difficulty lies in the constitution of the governing body, and usually the smaller the district the greater the difficulty. When people live together for many years strong friendships and bitter animosities are bound to arise, and they cannot fail to penetrate the recesses of the council chamber. The municipal engineer in his official capacity is not recognised or protected by law, and he holds his position solely at the will of the council. In everything he does he runs the risk of offending individual members of the authority or their friends, or what is probably equally as bad, of pleasing their enemies. The result is the same, and he goes through life with the knowledge that the machinations of a few may at any moment bring about the termination of his appointment and prejudice his prospects of obtaining a livelihood in the future.

Security of tenure requires that a municipal engineer shall not be dismissed except with the consent of a central authority. This Government control of dismissal cannot reasonably be expected unless the Government also controls the making of the appointment in the first place, and this in its turn involves an obligation to inquire into the competency of the engineer to undertake the duties of the appointment, and to determine whether the proposed remuneration is adequate. And, after all, this is no safeguard against the pin-pricks which sometimes make an engineer's lot unbearable, and drive him to resign his post in desperation. There appears to be great reluctance on the part of the Government to interfere in the actions of a local authority. Such body, or the individuals of which it is composed, are fully acquainted with the local circumstances and conditions, and must be given credit for ordinary intelligence, while, at any rate, they have been elected by the ratepayers to act as their representatives and to govern the district according to their wishes. It is only by showing that municipal engineers are hampered in their work by the present unrestricted control of a locally elected body, and that the community as a whole suffer seriously therefrom, that Government intervention will be secured. We must acknowledge the good work that is being done to this end by the National Association of Local Government Officers, with which body the Institution of Municipal Engineers is affiliated, but at the same time we can individually help the cause by collecting particulars of those cases coming under our notice which bear upon the matter.

There is another method by which better conditions could be obtained, and which would eventually lead to Government recognition and Government protection, and that is for municipal engineers to form themselves into a great brotherhood—call it a trade union if you will—each pledged to decline to accept or to retain any appointment the conditions of which are unsatisfactory; and all undertaking to give support, financial if need be, to weaker brethren who, by pressing necessity to maintain themselves and their families, might be tempted to accept or continue to hold such a post. No one professional society could do this, however powerful it might be, and I appeal to all qualified municipal engineers, whether belonging to any particular society or not, to sink any differences they may have, and, in this one particular and for this one object, to unite in the common aim of improving the conditions of life for themselves and their fellows. This is not the time or place to elaborate the idea, but when the will is expressed the means can soon be found.

I believe something of this sort was contemplated at the time of the formation of this Institution, but it was evident that there were many men who, by virtue of the position they occupied, claimed to be considered as municipal engineers and desired enrolment, but who had not received such training, or acquired such experience, as could reasonably entitle them to inclusion in our ranks, and consequently they had to remain outside. It is not right, and it is not reasonable, that protection should be accorded to untrained men, and if some local authorities are so little alive to their responsibilities as to employ such men, let us at least provide that when a qualified man is wanted he shall be treated in a manner fitting to his dignity as a member of an honourable profession.

I conceive that the energies of a local authority should be confined to the determination of matters of policy after the pros and cons of the engineering questions involved have been laid before them by their engineer; but in too many cases it appears that members of local authorities concern themselves far too much with purely engineering questions, and look upon the engineer as a man who is paid to carry out their wishes and to do what he is told.

TRAINING OF MUNICIPAL ENGINEERS.

It will be apparent that the proper training of municipal engineers is of the gravest importance in the interests of the profession. The time has long since gone by when it was possible for anyone to satisfactorily carry out the duties of surveyor to a local authority with a modicum of common sense as his only qualification, and while a greater experience will always enable a man to take the more important posts, there is a minimum of training which should be required before he should be deemed competent to hold any appointment at all. To be effective and advantageous, training must consist of two distinct phases, scientific training and practical training. Neither is sufficient in itself. One often sees advertisements stating: "Surveyor has vacancy for a pupil. Important work in progress." Experience on work in progress is important, and indeed essential; but if the work happens to be in the country or in a small provincial town, there is generally no opportunity for scientific training unless the surveyor has the time, the ability, and the willingness to impart the necessary instruction. If, unfortunately, he is not in a position to do so, the result is that at the end of the apprenticeship the pupil will perhaps have learnt how different materials are put together and how certain specific works have been constructed. But engineering problems are always of a more or less complex character, and there is no one exact solution that can be applied in every case; consequently when the pupil comes to his next scheme he could doubtless copy what he had seen done before, but without scientific training he would be totally unable to appreciate the different conditions; or, if by chance he did so, he would have no idea of all the various ways in which the problem might be dealt with, and it is only by the possession of this knowledge that he can hope to design suitable and economic schemes, and successfully combat the interference of amateur engineers. Even methods of road construction and maintenance, which until recent years were treated as matters of rule of thumb, demand scientific knowledge now that fast motor-propelled traffic has been permanently established.

In every specialised branch of engineering a thorough scientific training is considered to be essential, and it is surprising that in municipal engineering, which is a compendium of all engineering, comparatively little attention should have been given to it. Several universities and technical schools now include courses in municipal engineering in their curriculum, and while taking these classes the student is expected to take others of a more general character dealing with the fundamental sciences. In order to avoid a plethora of imperfectly trained men it behoves all engineers to refuse to accept anyone as a pupil unless he has had, or will have the opportunity of obtaining, a good scientific training; and a prospective pupil should be informed that unless he studies and acquires a competent knowledge of the basic sciences of his profession he will be heavily handicapped in his future career. What is to be understood by a thorough training can be appreciated from the opinion expressed a few weeks ago by an eminent engineer (W. Ingham, M.Inst.C.E., M.I.Mech.E., chief engineer to the Rand Water Board), when he said that an engineer of thirty years of age *who has had a thorough engineering training* is in as good a position to investigate an engineering scheme as were the well-known successful engineers Telford, Brindley, George Stephenson, Fairbairn, Smeaton, or Watt at the termination of their professional careers.

If an engineer is in a position to give the necessary instruction which will enable a pupil to properly appreciate the significance of what is done in practice, and can afford facilities for acquiring practical experience of a reasonably varied character, then it is incumbent upon him to extend a helping hand if he can to those who are desirous of entering the profession; at the same time, he is entitled to receive—nay, more, it is his duty to demand—an adequate premium. The practice of some authorities in com-

manœuvring a share of the premium is iniquitous; they have no qualifications to instruct a pupil, or ability to render value for the money received. The acceptance of a pupil imposes a heavy responsibility, and should not be lightly entered upon. Any attempt to force an engineer to take a pupil with the sole idea of eking out an inadequate salary should be strongly resisted.

Occasionally one sees advertisements for municipal appointments in which it is stated that candidates must be corporate members of the Institution of Civil Engineers. The question as to whether such qualification is any criterion of the ability of a man to perform the duties of a municipal engineer has been warmly discussed from time to time. In my opinion the answer is decidedly in the negative; but it should be noted that such membership is evidence of a thoroughly sound general education and of extensive scientific training, and with these advantages the individual is in a most favourable position for rapidly acquiring practical experience and using it to the best advantage of those utilising his services, and the highest municipal appointments will in course of time come within his reach.

Turning now to more technical matters, there is such a wide range of subjects of direct interest to municipal engineers that it will be desirable in the time at my disposal if I confine my remarks to those branches of municipal engineering with which I am more closely identified at the present time—namely, sewerage, water supply and structural work.

SEWERAGE.

It is not so many years since the recognition of the action of bacteria in the purification of sewage was hailed as the solution of the sewage problem, and the principal outlet for ingenuity was held to be the consideration of efficient and economical means for the disposal of the sludge. The results of investigations during recent years show, however, that we are as far off as ever from reaching finality. For domestic sewages, septic tanks and percolating filters are adopted in such a large number of cases that they might almost be described as the standard system of the present day. On the whole, this combination is very efficient and fairly economical. The main cost of such works lies in the filters, or, to be more exact, the filtering medium, and future developments may be looked for in the direction of perfecting methods of oxidation and nitrification of the sewage without recourse to expensive filters. The methods of purifying sewage in manufacturing districts vary very considerably in accordance with the nature and proportion of trade wastes which may happen to be present. Excessive variation in the volume and character of the sewage owing to the uncontrolled discharge of trade wastes adds to the difficulty and expense of treating it. The construction of special storage or equalising tanks, and cordial co-operation between the manufacturer and the local authority, will go far to overcome the troubles.

The sewerage of sea-coast towns presents peculiar features which are absent in works for inland towns, and which are sufficient to render it a special branch of sewerage engineering. The old idea that so long as the sewage could be discharged into the sea there was an end of it is quite exploded, and the dangers arising from an improperly devised scheme are well known. The prosperity of many sea-coast towns depends solely upon the revenue derived from the visitors who periodically journey thither in search of health and pleasure; it is therefore essential to the interests of both the residents and the visitors that the sanitation should be as perfect as possible. Indeed, the visitors have a right to demand that when advertisements are issued inviting their patronage there shall be an implied guarantee that the conditions are such that their health will not be jeopardised. In designing an effective sea outfall scheme, the point of discharge, the volume of the sewage, and the extent of its treatment, if any, are mutually dependent upon each other. A small quantity of sewage can safely be discharged at a point where a large quantity could not be, and similarly a partially treated sewage could be discharged where crude sewage could not. The abnormal summer population may lead to nuisances which would not occur in the winter when only the permanent residents were in the town, and in the same way a sea outfall scheme which sufficed for a small population might have to be abandoned in course of time as the numbers increased. The cost of a sea-coast scheme is generally comparatively high because provision has to be made for a population greater than that directly assessed for the payment of it.

During the past year the Ninth and Final Reports of the Royal Commission on Sewage Disposal have been issued, and the labours of that body, extending over a period of nearly seventeen years, have been brought to an end. The commission has done a great work in collating the experience of practical workers in the realm of sewage disposal, and has pursued many investigations to extend that experience and to settle points which were in dispute or doubt. The matter published is so voluminous and is so badly indexed that it has been a matter of considerable difficulty to turn up any particular matter to which one wished to refer; consequently the "Guide" which has recently been published by the engineer to the commission forms a welcome appendix. The whole subject of sewage disposal has been dealt with principally from the chemical and bacteriological aspect. It is pointed out that, under certain conditions, with certain treatment, certain results may confidently be expected, but the engineering means by which the necessary treatment may be given to secure the required results are, naturally, treated very scantily. The reports have amply demonstrated that there are many ways in which sewage may be purified, but the means to be adopted to produce the best results will depend upon the circumstances of each particular case. In the design of a scheme the chief technical factors to which consideration has to be given may be summed up as:—

(1) A clear understanding of the conditions of each case and the disturbing factors.

(2) A suitable working-out of the details.

(3) Planning of the works to ensure a maintenance of efficiency, and economy in their management.

It is obvious that there is ample scope in these matters for the utilisation of expert knowledge and practical experience, so that, useful as the reports are, they do not eliminate the need for skilled engineers, or reduce the responsibility devolving upon them.

The conclusion of the commission's labours is only a milestone on the road of progress, and further and continuous research is necessary. It is characteristic of an engineer that he is never satisfied. It is his business to do things, but it is not sufficient to do them well, he must do them economically, and, having succeeded in one case, he strives in the next to secure still higher efficiency and greater economy. If money were no object a high state of perfection could be reached in every scheme, but this is not always necessary, and consequently it is of the utmost importance that an engineer should have a well-developed commercial instinct. It is useless designing or recommending schemes the cost of which, if carried out, would be ruinous to the ratepayers and prevent any other improvements being carried out in the district for many years to come. Finally, it is a *sine quâ non* to have an experienced man as sewage works manager; the work cannot be done by an ordinary labourer. A poor man will spoil the result from the best arranged works, while a good man may get a decent result from an ill-designed scheme.

WATER SUPPLY.

The importance of a piped supply of water laid on to each house is now so well recognised that the carrying out of such a scheme is one of the earliest developments when the growth of the population in any locality renders necessary some change from the primeval sanitation which had previously sufficed. So short a time ago as seventy years only about half of fifty large towns specially investigated had a piped supply under the provisions of any Act of Parliament; the supply was very defective, and in many cases it only extended to a part of the town. Thirty years ago, out of the 944 urban sanitary districts then existing, 241—that is, more than 25 per cent—had no piped supply at all, and in many of those which had such convenience, only small parts of the districts were supplied. Now, out of 1,130 boroughs and other urban districts, there are only sixty-seven in which fewer than half of the residents have a piped supply, while twenty-nine are without a piped supply at all, but these latter are generally very small places.

In the rural districts piped supplies are gradually becoming more numerous, but there are still about 8,000 parishes, with a total population of several millions, which have no proper supply, while in many other cases only parts of the parishes have piped supplies. The wells, ponds, streams, springs, and rain water, upon which these people have to rely, are in many cases either definitely impure or are extremely liable to pollution; although, on the other

hand, some of the water is of excellent quality. Important as the purity of the water is, notice must also be taken of the proximity of the supply to the houses. It is generally conceded that the minimum quantity of water with which it is possible to secure anything approaching reasonable cleanliness is about 8 gallons per head per day; which quantity, of course, does not allow for water-closets or fixed baths being used, nor for any public services or waste. Where water has to be carried any appreciable distance the consumption is usually much less. In a case I recently investigated it was as low as 2¼ to 3 gallons per head per day, and the result was very obvious in the condition of the property and utensils. The tenants were not naturally dirty, but it was a physical impossibility for them to carry more water than they did. A supply within 200 ft. is usually considered to be a reasonable distance, but I would personally be disposed to reduce this by at least one-half, and then would look upon it as a temporary expedient until such time as the water could be laid into each house. An ample supply of pure water is as essential to our well-being as an ample supply of fresh air, and it should be equally within the reach of all.

It is common knowledge that there are still a large number of districts in which a proper supply of water is urgently needed, but it is becoming more and more difficult to provide a piped service at a cost that is reasonable and within the capacity of the inhabitants to pay for. In most cases where the centre of population is within a short distance of an abundant supply of water at a suitable elevation, schemes have already been carried out, and but little difficulty will be experienced in finding ways and means of carrying out further schemes as they become necessary in similarly placed localities; but when the only possible supply exists at a distance of several miles, and when perhaps pumping is also necessitated, it cannot be wondered that there should be hesitation in embarking upon the expenditure.

In some cases distinct advantage would accrue if rural districts or parts thereof were combined for purposes of water supply. This can be done by the Local Government Board, under sec. 279 of the Public Health Act, 1875, upon joint application being made by the authorities concerned. Unfortunately, neighbouring districts frequently have a strong disinclination to co-operate, unless it happens that both require a supply of water at the same time and cannot obtain it otherwise. A similar disinclination to co-operate exists in the case of adjoining parishes in the same district. It might easily happen that, while co-operation would ultimately be advantageous to both parties, at the moment one party only would reap the benefit while the other would be temporarily at a disadvantage—as, for instance, where one parish badly in need of water has to go to obtain a supply into and beyond an adjoining parish which, although unpiped, has a fairly adequate supply for present needs. Obviously both parishes could be provided with a piped supply for practically the same cost as the one first mentioned, but the residents of the second parish will hesitate to incur any expenditure upon a scheme which they will not need for some time to come, and, so far as they can judge at the time, may possibly never need. If the scheme is carried out for the first parish alone, the works will be designed on the requirements of that parish only, so that they would probably be unable to give a supply to the second parish when it was wanted, and a considerable expenditure, which might have been avoided, would be incurred in providing the second supply. If the water were obtained from an impounding reservoir there would be another, and a more serious disadvantage, and that is the waste of valuable water. The position of the dam will be fixed by physical conditions, and while there may be a very extensive watershed above the dam, the reservoir would only be constructed of sufficient capacity to give the requisite limited supply; consequently, if no other suitable sites exist for constructing other reservoirs in the same watershed, only a small portion of the water would be collected, and the remainder would run to waste. In order to conserve the water supply of the country it is desirable that ways and means should be found to construct every dam of such height that as much water as possible will be collected. A use for the water thus stored will be found at a later date, while the equalising of the flow in the river will be of advantage, in the present as well as in the future, to everyone along its banks. Obviously it would not be fair that the cost of the additional work involved should be borne by the community which only required and used a portion of the water.

It is interesting to note that when the Public Health (Water) Act, 1878, was in Parliament, the Select Committee which had it under consideration recommended that where a corporation or company proposed to take water from a rural district, Parliament should, before giving the powers sought, be informed of the wants of the district from which the water is taken, or through which the mains pass, in order to make provision for those districts. Such conditions were first inserted in the Manchester and Liverpool Water Acts of the following year. However, the Select Committee on the Water Supplies Protection Bill, 1910, refrained from making a recommendation that a supply should be afforded to districts through which the mains passed, though they thought that local authorities of districts naturally having recourse to the source proposed to be appropriated should be entitled to a supply therefrom. It is necessary in all cases where a rural district desires a supply under such conditions as these to formally oppose the Bill, when doubtless arrangements will be made to afford them facilities for the supply they require.

The cost per head of rural water supply is frequently much higher than in towns, and the people are usually less well able to bear it. The only remedy is to widen the incidence of the cost, and while something in this direction may follow the establishment of the proposed central authority, with subsidiary Rivers Boards (formed of joint committees of county councils, each having jurisdiction over the whole of a watershed and river basin), for the present some relief could undoubtedly be obtained if the county councils were made the water authority for rural districts within their area, and the cost of each individual scheme was levied on the whole county instead of on the particular contributory place or parish as at present. There is no reason, except the financial one, why the water supply should be less in quantity, or poorer in quality, in the country than in towns. It is indeed absolutely essential that the best possible supply should be given to farms where dairy operations are carried on, as serious epidemics may easily be caused through using contaminated water for washing vessels. With water supply schemes upon a broader basis the time may come when a piped water supply will be equally available to the farmers who may need it as to the inhabitants of the villages. The sources of supply should be carefully watched, and it should be an axiom that waste at the source should be prevented as much as at the place where it is used.

Among the places provided with a piped supply there are quite an appreciable number where the pressure is insufficient to cause the water to reach the topmost stories of the houses. It has fallen to my lot during recent years to investigate several cases of this nature, and the variety of circumstances, or combination of circumstances, by which the trouble may be caused are so numerous that the inquiry forms a most fascinating study, and provides ample scope for the exercise of deductive faculties. Frequently it is due to some simple matter which can be remedied without much, if any, expense; but in other cases it may be due to incrustation of the mains, or other more serious defect, which is not so easily cured. As there is no one cause of this growth in the pipes, so there is no one treatment that can be adopted to restrain it. If it is due to the nature of the water, scraping the mains gives merely temporary relief unless at the same time the water is chemically treated to alter its character. Incrustation is almost invariably accompanied by erosion of the metal. The earliest explanation was that it was attributable to rust formed by the moisture, but chemists pointed out that there must be a weak acid present, and this was given by the carbonic acid in the water. It was further suggested that, provided this acid was present to start the corrosion, it would subsequently continue indefinitely until the pipes were destroyed. The theory that it was due to electrolytic action received considerable support, but the latest explanation is that it is due to some low form of organic life. Be this as it may, the practical result is the growth of a number of limpet-shaped nodules or tubercles scattered at intervals over the surface of the pipes, although in bad cases they may be found to have accumulated to such an extent that not only is the whole surface covered, but the incrustation is built up so that the bore of the pipe is practically choked. If the material were merely deposited it would appear as a regular film, but while

sometimes it appears to start at a point and grow upwards and outwards in concentric layers of iron oxide and lime, at other times it has an almost [illegible] appearance, and the growths can only be described as tufted. It has been stated by Prof. J. Campbell Brown ("Proceedings," Institution of Civil Engineers, vol. 156) that incrustation practically ceases when a thickness of 1 in. or 1½ in. is reached. It must be noted, however, that the unevenness of the coating reduces the discharging capacity of the pipe far more than is proportional to the reduced area.

When mains are newly laid they generally have a surplus capacity, and, possibly owing to this fact, it is usually found that they will run from thirty to thirty-five years before incrustation causes serious trouble, by which time the conditions are probably aggravated by the natural increase in the population. In considering the question whether it is better to scrape or to renew a main, the critical diameter is about 6in. Above this it will generally pay to scrape, but below this size there are many points to be considered before a decision can be made. These smaller mains are generally distribution mains rather than supply mains; they are in shorter lengths, and have projecting ferrules from the house services at intervals. The eventuality of having to scrape the pipes should be taken into account when designing new schemes, in order that the dislocation of the service shall be reduced to a minimum. Among the provisions which should be made are hatch-boxes in brick chambers at suitable places, a plentiful supply of sluice valves, and arrangements for the easy disposal of the wash water without damage to the roads or adjoining lands; while a service reservoir near the town is of great assistance. It is generally found that when mains have been once scraped the operation has to be repeated again at more or less frequent intervals. It was reported recently that in Stirling County the mains had to be scraped every three months. Considerable progress has been made in the design and application of apparatus for scraping the interior of water mains. There are two principal types, one pressure-driven and the other power-driven. The decision as to which to use can only be arrived at after a full consideration of the circumstances of each case, but it can be said with certainty that the matter should not be settled on the basis of accepting the lowest tender.

REINFORCED CONCRETE.

With the exception of small highway bridges, comparatively little progress has been made in the application of reinforced concrete to municipal works. One factor is, no doubt, that much of the work to which it might be applied is small in character and in positions difficult of access or remote from the centres of population. To ensure satisfactory results it is essential that the whole of the work should be constructed by skilled labour under the direction of men with an extensive experience in such work. As these are not generally available in every district, the cost of the work would necessarily be high. Another, and perhaps the principal, reason is the extremely short period which the Local Government Board will allow for the repayment of loans for work done in this material. It would appear that in this respect the board have departed from their usual practice of fixing the loan period co-determinate with the probable useful life of the projected work, or the average life of work of a similar character, because it is well known that the actual life from numerous practical examples has already greatly exceeded the loan periods allowed; and it is surmised upon good and substantial evidence that its life is unlimited. Consider the two materials—concrete and steel. The concrete grows stronger the older it gets, and the steel, when properly embedded, is imperishable. When a structure is once loaded to its full extent without failure, but little fear need be felt as to its future, provided, of course, that the steel is not stressed beyond the elastic limit. If this is done it will stretch, and the concrete on the tension side will crack, and that on the compression side may spall, with the result that moisture will penetrate to the steel, causing rust and eventually leading to failure. The workmanship is most important, and the concrete must be dense in order that it may satisfactorily protect the steel.

Reinforced concrete, in common with some other branches of structural engineering, is to a great extent in the hands of individuals and firms interested in a particular form of construction, or, to adopt their own title, "specialist firms." In small steelwork structures, such as simple roof trusses, portable iron buildings, &c., it is common for the manufacturers to design the work and afterwards to supply the materials, or the completed structure. In reinforced concrete it is more usual for a "specialist firm" to design the work, which is subsequently carried out by a "licensed" contractor. The design of reinforced concrete is based on well-known fundamental principles of mechanics, although practical experience shows that it is desirable to make certain allowances which are not necessary under other circumstances. No doubt in the future every civil engineer will acquire knowledge in this branch as a matter of course, in the same way he now studies brickwork, but at present such knowledge is not general, and, apart from the "specialist firms," there are only a limited number of independent engineers who are qualified and competent to design such work, or to verify the calculations relating thereto. The latter men are, however, now sufficiently numerous to cope with the amount of work to be done, only their natural modesty, to say nothing of professional etiquette, prevents their existence being so well advertised as that of the "specialist firms." The result is that the bulk of the work is in the hands of such firms, and the usual practice is for general designs or sketch plans to be sent to some half-dozen of them, who each spend valuable time and money in preparing detail designs and tenders for the work. The work of some of these firms may be above criticism, but there are others who betray lamentable ignorance or carelessness. All schemes, however, with a view to cheapening the cost, are naturally based on the minimum requirements, and the margin for contingencies in workmanship and materials is of necessity small. It must not be supposed that the client reaps the whole of this advantage of competition, because the cost of preparing the design, and not only the accepted design, but many others for other clients which have not been accepted, must be charged in the tender. I am informed that in a case recently heard in the courts it was given in evidence that it was the custom of the "specialist firm" concerned to charge 10 per cent upon the cost to cover the designing charges. It would be advantageous if these and similar items were set out separately in tenders, as it would be efficacious in demonstrating to the public who employ engineers in a professional capacity that the money paid direct to them by way of salary or fees is far from being unreasonable having regard to the services rendered.

After designs have been obtained in the way described, and one has been selected for construction, the Local Government Board sometimes requires that it shall be subjected to an independent opinion before a loan will be sanctioned, and this, of course, means further expense in fees. There is no reason at all why reinforced concrete work should be treated differently from, say, sewage works or waterworks. It might be argued that it is like buying a single article, but even so, the interests of the client demand the preparation of a detailed specification, and subsequently the exercise of sufficient skill and experience to see that the conditions of the specification are fulfilled in the design and in the construction.

The reinforcement of concrete for road beds by means of a network of strong steel wire presents several points of interest, but as it is anticipated that this application of the material will form the subject of a special paper to be presented to the Institution for discussion at a later date, I will limit my remarks to a brief consideration of the road as an engineering structure.

The object of the steel is to give rigidity to the concrete, and thus distribute the load in order to prevent the ground "giving" under the point of application of the load. The upper part of the concrete has also to resist percussive action, either direct or transmitted, but the reinforcement will not give any assistance in this direction.

The camber of the road is so small in proportion to the span, and the concrete is so thin, that the arching effect is negligible; and, further, rigid abutments, which are essential to secure such effect, are not always present or obtainable; consequently the concrete must be considered as a slab resting upon a more or less yielding substratum.

If the foundation were uniformly soft, then single reinforcement only would be necessary, and the steel should be laid, say, 1 in. up from the underside of the concrete. If, however, the ground varied so that, while some parts were firm, others were liable to yield under the load, the road-bed slab would be in the position of a continuous beam, and double reinforcement would be required over what may be called

the points of support. To put the reinforcement in the middle of the depth of the concrete would be of very little use, as it would throw the neutral axis so high that a very great compressive stress would occur on the upper part of the concrete, which might crush; but probably before that occurred the lower part of the concrete would crack under the tensile stress it would have to bear, when the damp would soon destroy the steel.

Some of the members may possibly have noticed from the technical papers that a High Court action was recently brought by the Gas Light and Coke Company to restrain the Woodford and Wanstead Urban District Councils from using wire fabric road reinforcement on the ground that its use would be a serious hindrance to the company in getting down to their mains. Experimental lengths were constructed by the gas company of reinforced concrete 6 in. thick and ordinary concrete 12 in. thick, upon which at a later date workmen were put to open through. It was found that the reinforced concrete was cut through in a shorter time than the thick bed of ordinary concrete, and the gas company thereupon withdrew the action.

Reinforced concrete is a comparatively new form of construction, and as there is much more to be learnt from failure than from success, if any failure of a reinforced concrete structure comes under the personal notice of any member of the Institution he will be rendering a service to the profession at large if he will collate as many authentic pertinent particulars as possible and communicate them to the council, either for publication or for filing for reference.

COST OF WORKS.

The Treasury restrictions on the raising of loans have practically put an entire stop to the construction of all municipal works, and incidentally have removed the means of livelihood from many people who were dependent upon the carrying out of such works. When these restrictions are withdrawn we shall be faced, as we were before they were instituted, with the difficulty of the high cost of construction. In the past, sanitary works, and other works which were not of an obviously remunerative character, were postponed as long as was possible on the score that the expense could not be afforded. What will be the effect in the future if such works cost perhaps 10 to 20 per cent more than before, while the individual capacity for paying for them is very materially reduced? My own opinion is that the constructive cost of engineering works will never be appreciably lower than it is at present. The increase is almost entirely due to the high wages paid for the labour—not only that directly engaged in the construction and erection, but in that required for the production of the materials and commodities employed. Bearing in mind the strength of its organisation and the successive steps by which Labour has secured a place in the sun, it requires a very sanguine temperament to anticipate the acceptance of any appreciable reduction from the wages which have now been secured.

I will now bring my remarks to a close with the hope that the coming year will bring peace to our country, health and prosperity to our members, and a continuation of the success which has marked the growth of our society. If there is anything I can do at any time to advance the interests of the profession to which we all have the honour to belong, and those of this Institution of Municipal Engineers in particular, I shall only be too happy to be of service.

VOTE OF THANKS.

Mr. HORACE BOOT proposed a vote of thanks to the president for his address. This was seconded by Mr. E. WHITWELL (Abersychan), and supported by Mr. J. W. WILSON (principal of the Crystal Palace School of Practical Engineering), and passed with acclamation.

Institute of Sanitary Engineers.—At a meeting of this body to be held on Wednesday, February 2nd, Dr. Gilbert J. Fowler will read a paper dealing with the activated sludge process of sewage purification.

Grantham Sewage Farm Crops.—The gross amount realised at the annual sale of root crops at the Grantham farm was £383 14s. 6d. on an area of 40 acres, against £297 15s. last year when the area was 48 acres.

Glasgow Corporation Tramways.—Glasgow Corporation tramway receipts for the past six months totalled £568,000, or almost £40,000 more than in the corresponding six months last year. The passengers carried exceeded 177,500,000, an increase of nearly 13,000,000. The remarkable traffic is largely due to munition work on Clydeside.

CORRESPONDENCE.

Εις ἀνηρ ὁν παντ' ορᾶ
(One man does not see everything.)
—EURIPIDES.

A CORRECTION.

To the Editor of THE SURVEYOR.

SIR,—I write to point out what appears to me to be a mistake in the very interesting article entitled "The Experimental Determination of the Effect of Varying Percentages of Water in Concrete," by R. K. Skelton, which appears in your issue of Friday, September 24, 1915.

In paragraph 3 on. p. 328 the author states: "All materials were mixed dry, and the amount of water, *exclusive* of that required to moisten the sand and stone, was varied from 20 to 42·5 per cent of the weight of cement." In paragraph 5 on the same page he states: "The water in each represented 2·1 per cent of the weight of the stone, plus 10 per cent of the weight of the sand, plus the percentage of the cement by weight as indicated."

Now, 20 per cent 35·1 cement equals 7·02 lb.; but, as will be noted from Table 1, the weight of the water is given as 15·2 lb. If the 2·1 per cent of the weight of the stone and 10 per cent of the weight of the sand given in line 1 of Table 1 is added to the 20 per cent of the cement, we obtain the following figures: -

20	per cent of	35·1	= 7·02 lb.
21	per cent of	120·7	= 2·53 lb.
10	per cent of	56·5	= 5·65 lb.
Total weight of water			15·20 lb.

The above is the figure given by the author. It therefore appears to me that the word *exclusive* in the first paragraph I refer to should be *inclusive*.—Yours, &c.,

L. P. MARSHALL,
Chief Engineer, Rangoon Municipality.

Rangoon.
November 5, 1915.

PROPOSED NEWCOMIN MEMORIAL.

To the Editor of THE SURVEYOR.

SIR,—It is proposed to establish at Dartmouth a permanent memorial to Thomas Newcomin, inventor of the atmospheric steam engine, and it has been suggested that it should take the form of a statue, a bust on pedestal, or an obelisk suitable for erection in the public gardens.

Unfortunately, the amount subscribed is not large, and probably not more than £140 would be available, but I should be glad to receive any suggestions from your readers on the subject, and to know whether a presentable memorial could be obtained for the amount I have stated.

Thanking you in anticipation of the insertion of this in your valuable journal.—Yours, &c.,

T. F. CASTON, Hon. Secretary,
Newcomin Memorial Committee.

South Ford-road,
Dartmouth,
Devon.
November 29, 1915.

Local Government Board Officials in the Forces.—The number of men of military age in the service of the Local Government Board at the outbreak of war was 340. Of these, 157 have already joined the Forces, and 121 more have expressed their readiness to join, subject to consent being given. Of the balance, thirty-one have presented themselves before the recruiting authorities and have been rejected on medical grounds. In addition to the men of military age who have joined or are ready to do so, some forty members of the staff outside military age limits have undertaken military duties.

Private Bills: Effect of Treasury Restrictions.—Plans in connection with private Bills to be considered in the forthcoming session have now been deposited in the Private Bill Office of the House of Commons. Bills without plans may be deposited up to December 17th. There is a great falling off in the number deposited owing to the Treasury restrictions on the spending of money by local authorities. The plans deposited number only 15, as against 158 last year. Railways number one, against four last year; tramways none, against ten; miscellaneous five, against thirty-five; and Provisional Orders nine, against 109.

Treatment of Water with Hypochlorite.*

By JOSEPH RACE, F.I.C.

In a paper presented in 1912 the author dealt at considerable length with this important phase of hypochlorite treatment, and pointed out that efficient mechanical intermixture of the hypochlorite solution is much more effective than a prolonged contact period without this admixture. Certain conditions in Ottawa enabled further observations to be made on this important point. In June, 1914, a sedimentation basin was placed in operation at the mouth of the Ottawa intake pipe, and during July the hypochlorite solution was added at the entrance to this basin. The method of addition was by means of a perforated pipe which stretched across the entrance to the basin, and the bleach solution and water were there mixed as thoroughly as was possible without having recourse to mechanical methods. The basin was baffled and had a normal capacity equal to approximately two hours' consumption. The results obtained were as follows:—

AVAILABLE CHLORINE—1·55 P.P.M.

Bacteria per c.c.

	Agar 5 days at 20° C.	Agar 1 day at 37° C.	B. coli index per c.c.
Raw water	110	104	0·280
Treated water	19	26	0·036
Percentage purification	88·2	75·0	87·5

During August the connection at the entrance to the basin was closed and the bleach liquor added directly to the suctions of the low-lift pumps, which take water from the sedimentation basin and place it in the intake pipe under a small positive pressure until it reaches the high-lift pumps. During both months the samples of treated water were taken from the well which receives the mixed discharges of the low-lift pumps. The results for August were:—

AVAILABLE CHLORINE 1·55 P.P.M.

Bacteria per c.c.

	Agar 5 days at 20° C.	Agar 1 day at 37° C.	B. coli index per c.c.
Raw water	148	100	0·600
Treated water	26	12	0·005
Percentage purification	91·9	88·0	99·2

These results, which are the averages of daily analyses, show that the efficient mechanical admixture produced much superior results with a smaller consumption of chlorine.

It is probable that the superior efficiency claimed for "liquid chlorine" is due to the fact that the older plants using bleach have been slow to recognise this essential factor, while the plants using "liquid chlorine" have, by various devices, secured more or less efficient admixture, with the consequence that equally satisfactory results have been obtained with a decreased dosage. As shown above, 1·55 p.p.m. of chlorine as bleach gave good results with the Ottawa River water, while Harrington (Journal, American Waterworks Association, vol. 3, p. 438) stated that 1·50 p.p.m. of available chlorine, as liquid chlorine, was required for the sterilisation of the Ottawa River water at Montreal.

During January, 1915, laboratory experiments were made to ascertain what proportion of chlorine would be required when the admixture was as perfect as could be obtained by shaking. The results with a water containing 45 parts per 1,000,000 of colour and to which a culture of B. coli was added were as follows:—

Contact period.	Chlorine, parts per million.			
	0·30	0·40	0·55	1·21
	Colonies per c.c.			
Raw water	380	380	750	750
1 min.	110	12	<0·1	<0·1
10 min.	72	0·5	<0·1	<0·1
20 min.	35	<0·1	<0·1	<0·1

These figures show that, with satisfactory admixture, 0·4 to 0·5 part per 1,000,000 of available chlorine is sufficient to secure good results, and they led to various changes being made in the pipes delivering the hypochlorite solution at the mouth of the intake, in the direction of securing a still greater efficiency in the mechanical admixture. Up to date this has enabled the quantity to be reduced from 1·3 parts per 1,000,000 to 0·83 part per 1,000,000, which is equivalent to a saving of $1,400 per annum, calculated on the present price of bleach.

EFFECT OF TEMPERATURE.

During the present winter there have been several periods during which the results obtained with the city supply seemed to indicate that the low temperature had a retarding effect upon the velocity of the reaction, but as these results were somewhat complicated by the length of time that elapsed between sampling and examination, laboratory tests were made to determine this point. The original water contained 45 parts per 1,000,000 of colour, and was, after seeding with B. coli, treated with 0·51 part per 1,000,000 of available chlorine. The results were as follows:—

	Temperature, deg. Fahr.			
Initial	34	40	52	70
Final	40	44	55	68
	Colonies per c.c.			
Raw water	750	750	750	750
Treated water—				
After 1 min.	3·2	1·0	0·2	nil
After 5 min.	2·5	0·8	0·2	nil
After 20 min.	2·2	0·6	0·1	nil
After 60 min.	1·9	0·5	0·1	nil

These results show clearly that the velocity of the reaction is undoubtedly lowered by a reduction of the temperature; a similar conclusion is reached by a study of the rate of absorption of free chlorine as indicated by the starch and iodide reaction.

COLOUR AND TURBIDITY.

The organic matter, which is the cause of the colour of many waters, undoubtedly increases the amount of chlorine required for the sterilisation of such waters, though probably not to the extent that it is usually considered to do. This former hypothesis was based on results obtained with imperfect admixture, when areas of unequal concentration occur, with the consequent loss of chlorine owing to its prolonged localised action upon the organic matter. The point of interest in water purification is not the amount of chlorine a coloured water will absorb before showing a free chlorine reaction, but what quantity of organic matter it is necessary to oxidise before the chlorine causes the delicate organic structure of the bacteria to lose its anabolic functions. These two quantities may approach each other when the temperature of the water is near the freezing point and the contact period is short; but with a temperature of 70 deg. Fahr. and a contact period of but ten minutes, the former quantity is approximately three times as great as the latter for the Ottawa River water.

The increase of this factor is a matter of considerable importance to sanitarians, as it involves a decrease in æsthetic objections, in addition to an increased economy in working costs.

Increased turbidity also usually decreases the efficiency of the hypochlorite treatment, though the reason for this is by no means clear. If the turbidity is caused by finely divided silt or other mineral matter, no effect should be produced by it, as such matter is inert; the inferior results obtained with such waters are probably due to factors which are introduced concomitantly with the turbidity and by the same cause. When turbidity is caused by the flooding and scouring of cultivated areas, much of the suspended matter is of an organic nature, and often encloses masses of bacteria which can only be destroyed by a large increase in the proportion of chlorine. In the case of coloured river waters an

* Paper presented at a meeting of the Society of Chemical Industry (Canadian Section) held at Montreal.

increased turbidity is usually accompanied by a decreased colour, so that these two adverse factors counterbalance each other to some extent.

BENEFITS FROM TREATMENT WITH HYPOCHLORITE.

During the two years immediately preceding the installation of hypochlorite treatment in Ottawa, the typhoid rate averaged eighty-five deaths per 100,000; after treatment commenced the rate was reduced to twenty-one the first year, and to thirteen, four of which were due to disease contracted outside the city, in the subsequent year. It is only fair to add, however, that this decrease is not entirely due to the chlorine treatment, as the epidemic rates were caused by a leakage of sewage into water intakes, which were subsequently replaced by comparatively watertight pipes. During 1914, however, a concrete example of the benefits derived from hypochlorite treatment was obtained. In the autumn of 1914 an epidemic of typhoid broke out in a village on the Ottawa River, about 8 miles above the mouth of the Ottawa intake pipe, and in a few weeks about 150 to 200 cases developed. During November and December about 200 cases of typhoid were discovered in Hull, which takes its water supply from the Ottawa River within 400 yds. of the Ottawa intake mouth, while in Ottawa only twenty-eight cases were reported, and of these 60 per cent were due to outside sources. Hull, with the untreated water supply, had a typhoid incidence of 1,000 cases per 100,000 of population, and Ottawa, using a treated supply from the same current of the same river, only twenty-seven cases per 100,000 during the same period. In this example all the factors were favourable to the infection of the Ottawa and Hull supplies, as the temperature and volume of the water were low, thus increasing the viability of the typhoid organisms and decreasing the dilution of the infecting sewage. The enormous volume of the river even at low-water mark (probably about 20,000 cub. ft. per second) alone prevented a still more serious epidemic.

HYPOCHLORITE PLANTS.

Material of Construction.—The great difficulty in this connection is to obtain materials which are economical and yet capable of resisting the corrosive action of hypochlorite solutions. For very dilute solutions (0·2 per cent of bleach) this problem presents little difficulty, but the use of solutions of this strength is not good policy on account of the large increase in capacity involved. Two years ago a plant was constructed in Ottawa capable of treating 20,000,000 gallons per day, and consisting of three large circular wooden tanks, in which the bleach and water were thoroughly mixed by electrical motors connected directly to a shaft to which propeller blades were attached. Two of these tanks were of oak and one of cypress, and it was found that a 1 per cent bleach solution rapidly leached the wood and produced leaks that it was impossible to repair. The inside surfaces of these tanks were then thoroughly washed and painted with several coats of what was claimed to be an acid-resisting mixture. This treatment was efficacious for a time, but after a few months the leakage was as great as ever. The tanks were then lined with a 3-in. coat of concrete, the surface of which was painted with asphaltum. This has been comparatively satisfactory, and, when a new plant was erected about twelve months ago, was instrumental in deciding to eliminate all wood material and to use concrete painted with asphaltum wherever it was possible. Lead-lined wooden tanks may be used for vessels of small dimensions in which the sheet lead can be placed without joints. In tanks employed for mixing bleach solutions by mechanical methods the author's experience has shown that cast aluminium blades attached to a bronze shaft produce the best results. After considerable use the aluminium blades become coated with an incrustation which prevents corrosion of the metal. For piping, the Ottawa results show that galvanised iron gives good results when the piping is of generous dimensions and when plugged "T's" are placed at all bends for removing incrustation. In piping systems experience shows that it is incrustation rather than corrosion that produces difficulties, and that the material has but little effect. In valves the converse holds true, as the friction of the various parts prevents the formation of a protective coating, and constantly presents fresh surfaces for the action of the solution. Soft brass valves are useless, but gate valves made of hard bronze have been found satisfactory. Vulcanite valves may also be used, but are expensive as regards first cost and require careful manipulation to prevent fracture.

When gravity systems are used for the introduction of the hypochlorite solution, the ball valve used for maintaining a constant head should be made of bronze with a glass float, and the orifice of glass. This method of operating with a known head of water on a circular orifice has given perfectly satisfactory results in Ottawa and at many other places. The mixing operations of a hypochlorite plant should be checked by daily analyses of the liquor, so as to prevent wastage and irregular addition.

COMPLAINTS.

Numerous objections have been raised against the use of water which has been treated with hypochlorite. Some of these have been previously mentioned in connection with the Toronto supply (*loc. cit.*), but these might again be considered, as the water under discussion, being entirely different in character, presents new aspects of this problem. A typical analysis of the Ottawa River water is as follows: Free ammonia, 0·004 part per 1,000,000; alb. ammonia, 0·096; nitrites, trace; nitrates, 0·055; chlorine, 1·5; total hardness, 37·0 carbonic acid, 1·0; oxygen absorbed in four hours at 27 deg. Cent., 5·50. The physical characteristics are:—

	Average.	Maximum.	Minimum.
Colour	67	90	40
Turbidity	16	300	3
Alkalinity	26	47	14

With such variations in colour and turbidity it is obvious that the addition of hypochlorite cannot be maintained at a constant rate, but it has been regulated so as to have, whenever possible, no free chlorine, as indicated by the starch and iodide reaction, in the water delivered to the mains at the high-lift pumping station. This has resulted in a comparative absence of complaints regarding the cold water; but there is no doubt that, after heating, the water possesses a peculiar odour, due to chlorine compounds. This odour is not the sharp, acid odour of chlorine, but a fishy one, which is possibly caused by such compounds as chloramines.

Complaints regarding the effect on animals have been made, and a number of these have been investigated. It is undoubtedly true that when the amount of free chlorine in water reaches 0·5 part per 1,000,000, both small and large animals refuse to drink such water entirely or absorb only small quantities. This possibly has had an adverse physiological effect. When the water is capable of absorbing as much as 1·5 parts per 1,000,000 of chlorine without showing free chlorine, naturalists who deal in small animals and fishes state that no effect is observed. Continuous physiological tests on minnows and gold-fish confirm this. The Dominion Department of Fisheries has informed the author that free chlorine in the water had a markedly adverse effect on the hatching of the eggs of Atlantic salmon, Great Lake trout, pickerel, and whitefish; but no effect was noticed when free chlorine was absent. The department has, however, decided to remove all the hatcheries to places where water free from chlorine can be obtained.

The effect of the treated water upon seeds, plants and flowers has been investigated by the Dominion Department of Agriculture, and Dr. Gussow (Dominion Botanist) and Dr. Shutt (Agricultural Chemist), who were in charge of this work, have reported that water treated with hypochlorite caused no apparent injury to carnations and hybrid roses. Six varieties of wheat seed after soaking in freshly prepared hypochlorite solutions (0·05 to 10 parts per 1,000,000 available chlorine) were all sown on the same day. Germination was found to be uniform throughout, and no influence could be detected either as regards the rate of germination or the development of the young plants. Experiments on barley and oats produced similar results. Radishes, turnips, cucumbers, and beans also showed no retardation in development after treatment with the water.

All these experiments were conducted with solutions of bleach in distilled water, but the same results were obtained in a later series when the treated city supply was used. These results prove conclusively that statements alleging damage to plants, flowers, and seeds by the hypochlorite treatment of water are absolutely unfounded and do not merit the slightest consideration.

The author has had on several occasions during the past year to investigate cases of alleged corrosion

The Surveyor
And Municipal and County Engineer.

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of piping due to the hypochlorite treatment of water, but before discussing these it will be advisable to review briefly the latest work on the corrosion of iron piping by water. The Committee on Water Supplies of the American Public Health Association have reported that, in general, hard waters have given little or no trouble in corroding metal pipes, and that this is apparently due in considerable measure to the formation of protective coatings upon the metal by the water itself. Soft waters do not seem to form such coatings naturally, and allow the carbonic acid in the water to dissolve such metals as iron and to retain the iron in solution. This process is maintained until the whole of the dissolved oxygen has been absorbed.

Jackson and Hale (New York Water Department Report, 1912) found that the first reaction is the solution of iron as bicarbonate by carbonic acid, with the formation of hydrogen. In experiments carried out in the cold, about 20 deg. of the hydrogen formed was oxidised to water by the dissolved oxygen near the surface of the iron. The dissolved oxygen at the same time oxidises the soluble iron bicarbonate to insoluble red oxide, setting free again carbonic acid. The carbonic acid liberated again dissolves more iron and is again set free until all the dissolved oxygen is exhausted.

These reactions are in accordance with the facts which have been observed in connection with corrosion of piping systems, and account for the rapid corrosion of both domestic and heating hot-water systems. Methods which reduce the oxygen content will reduce the corrosion, but it is much more economical to eliminate the catalytic agent which enables the oxygen to produce its deleterious effect.

In view of the alleged corrosion of hot-water systems in Ottawa, the author made routine determinations of the amount of free carbonic acid in the raw and treated waters; the average results for the year 1914 are as follows: Raw water, 0·8 part free carbonic acid per 1,000,000; treated water, 1·6 parts. During the early part of the year, when a bleach of high chlorine content was being used, the free carbonic acid in treated water was invariably higher than in the raw water, but the reverse was found later in the year, when the bleach invariably contained free lime. As the total amount found (maximum 2·7 parts per 1,000,000) is insignificant compared with the 10 to 12 parts per 1,000,000 of half-bound carbonic acid which would be set free during heating, it is inconceivable that the treatment of water with hypochlorite has any effect on the corrosion or erosion of piping systems.

One example of the complaints received is worthy of mention. A large company alleged that hot-water pipes had been damaged by the hypochlorite treatment to the extent of $40,000. On investigation it was found that the system had been supplied by the treated city water after passage through a mechanical filtration plant, and finally sterilised by heat. In this plant aluminium sulphate and soda ash were employed, and it was found that a large excess of soda ash was being used. At one time the water passing to the filter showed an alkalinity to phenolphthalein equivalent to 65 parts of sodium carbonate per 1,000,000. The New York experiments have shown that an excess of lime or soda ash beyond what is sufficient for the neutralisation of the free carbonic acid is not only unnecessary, but positively injurious, inasmuch as it rapidly attacks the galvanising coat of pipes. These facts were pointed out to the company, and the suggestion made that a small amount of lime should be substituted for the excess of soda ash. Since then no further complaint has been received.

During 1914 laboratory studies were made as to the effect of water which had been treated with hypochlorite upon galvanised iron pipes, and in these, both hot and cold water were used. Stated shortly, the results show that the effect of the treated Ottawa River water upon galvanised iron pipe of good quality is not appreciable unless the available chlorine exceeds 3 parts per 1,000,000. The quantity used during 1914 has been invariably less than this amount, and averages 40 per cent less. A number of short lengths of pipe, procured for these tests from a firm which is supplied by makers manufacturing most of this class of pipe used in this section of the country, was found to be of very inferior quality. The galvanising coat was evenly and thoroughly distributed on the outside, but on the inside large patches of bare iron were found in some places, and an excess of zinc, which was brittle and easily detached, in others. Such places would undoubtedly act as foci of corrosion, and if the pipes received were at all representative of those ordinarily used, it is surprising that the trouble from this source has not been even greater than it is.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Llantarnam U.D.C. (November 17th. Mr. W. O. E. Meade-King).—£600 for the construction of a length of sewer, which will form part of the general scheme of subsidiary sewerage for the district.—The surveyor, Mr. A. Gordon Jones, stated that the council had received many complaints with respect to the sanitary condition of the district. The proposed sewer would be connected with other sewers now discharging into the Cwmbran brook.

APPLICATIONS FOR LOANS.

Benfieldside U.D.C.—£700 for sewage disposal works.

Branston R.D.C.—£350 for a sewage disposal scheme.

Milford Haven U.D.C.—£1,700 for the enlargement of the impounding reservoir.

LOANS SANCTIONED.

Aldershot U.D.C.—£812 for the extension of the isolation hospital.

Bideford U.D.C.—£4,338 (for thirty years) and £300 (for five years) for works in connection with the water supply.

Blaenavon U.D.C.—£504 in connection with the housing scheme.

Lincoln T.C.—£1,200 for a new boiler at the laundry and the building of a chimney.

Linthwaite U.D.C.—£1,378 for the Hoylehouse improvement.

Poplar B.C.—£3,688 for electric cable extensions.

Weymouth T.C.—£1,930 for electric mains and services.

LOANS REFUSED.

Carlisle T.C.—£9,582 for a housing scheme.

Wilts C.C.—£1,000 in connection with the Salisbury isolation hospital.

FORTHCOMING INQUIRIES.

DECEMBER. £

7.—**Beaconsfield.** For private street works (Mr. P. M. Crosthwaite) ... 1,500

7.—**Whitefield.** For works of sewage disposal (Mr. A. W. Brightmore) 2,595

7.—**Wincanton.** For the purposes of water supply (Mr. H. Shelford Bidwell) ... —

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The premium for November is divided between

Private B. KNIGHT (6th Inniskilling Dragoons),
Western Cavalry Depot,
Newport, Mon.,

and

Mr. J. G. WILKIN,
County Surveyor's Office,
Downpatrick;

whose contributions have, in the opinion of the adjudicators, been the best received during the month.

QUESTIONS.

This week answers are invited to the following questions:—

511. Tramway Construction.—Discuss spiralisation in tramway construction. (J. D., *West Hartlepool.*)

516. Beams.—Show how to determine the bending moment and shearing force at any point of a beam which is continuous over three supports and carries a uniformly distributed load.

517. Venturi Meter.—Describe, with sketch, the construction of the Venturi meter, and explain the hydraulic principles on which it is based. ("Hydraulics.")

518. Strength of Materials.—Explain clearly the meaning of the terms (*a*) stress, (*b*) strain, (*c*) modulus of elasticity. What is the relation between them?

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

514. Water Supply.—A storage reservoir and a service reservoir are situated at a distance of 5 miles apart, and are connected by a 12-in. main, which, at a point 1 mile from the service reservoir, feeds a 10-in. distributing main. The top-water levels of the storage and service reservoirs are 850 and 750 ft. respectively above ordnance datum, and the level at which the distributing main leaves the trunk main is 400 ft. above ordnance datum. When water is passing into the distributing main at the rate of 60,000 gallons per hour, what will be the (1) pressure in the trunk main at the connection with the distributing main? (2) the quantity of water passing from each reservoir towards that point? and (3) the hydraulic gradients from the reservoirs to the junction of the trunk and distributing mains? ("Ionic.")

In this question we have two reservoirs at different elevations discharging into one pipe—*i.e.*, the 10-in. distributing main—through two separate 12-in. mains. It is obvious that the reservoir with the greatest elevation will supply the whole of the flow, until the head lost by friction in so doing is greater than the difference in level between the two reservoirs. It is therefore necessary to first determine the flow from the pipe from the highest reservoir for a loss of head of 100 ft.—*i.e.*, 850—750 ordnance datum.

Using Box's rule—

$$G = \left(\frac{(3d)^5 \times H}{L}\right)^{\frac{1}{2}}$$

where G = discharge in gallons per minute
d = diameter of pipes in inches
H = head of water in feet
L = length of pipe in yards.

We have therefore—

$$G = \left(\frac{(3 \times 12)^5 \times 100}{4 \times 1760}\right)^{\frac{1}{2}} = 926{\cdot}765 \text{ gallons per minute.}$$

The given flow in the 10-in. main is 60,000 gallons per hour = 1,000 gallons per minute. It will thus be seen that the higher storage reservoir will supply practically the whole of this flow, and the deficiency of 73·235 gallons will be divided between the two mains. This division can only be found by trial and error. Before doing this, however, it is necessary to allow for the loss of head due to velocity of entry. It can be calculated by Box's formula for the purpose—

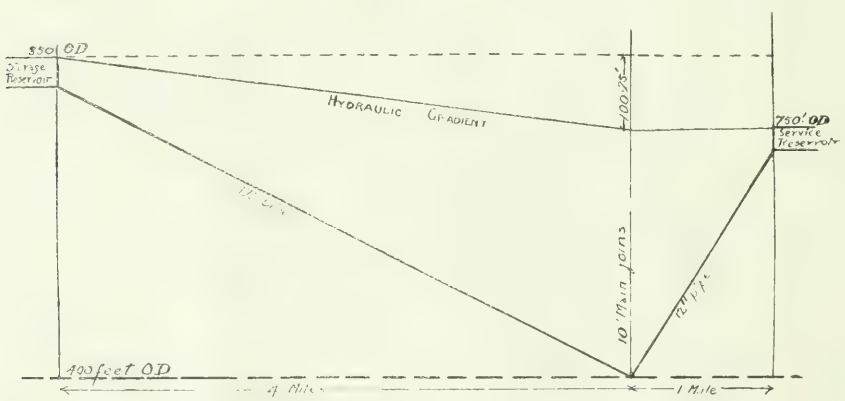
$$H = \left(\frac{G}{d^2 \times 13}\right)^2$$

Assume that the flow from the storage reservoir is 930 gallons per minute, then

$$H = \left(\frac{930}{12 \times 12 \times 13}\right)^2 = \left(\frac{155}{312}\right)^2 = \left(\tfrac{1}{2}\right)^1 = \tfrac{1}{4} \text{ or } 25 \text{ feet.}$$

The flow in the main from the service reservoir will be so slow that the loss of head due to velocity of entry may be neglected. We have now to find the flow in each main, as follows, working by trial and error:—

Take a head of 101 ft. from the storage reservoir, deducting ·25 for velocity of entry = 100·75 ft.



efficient head, and 1 ft. head from the service reservoir.

Then G from storage reservoir

$$= \left(\frac{(3d)^5 \times H}{L}\right)^{\frac{1}{2}} = \left(\frac{(3 \times 12)^5 \times 100{\cdot}75}{4 \times 1760}\right)^{\frac{1}{2}} = 930{\cdot}24$$

and G from service reservoir

$$= \left(\frac{(3 \times 12)^5 \times 1}{1760}\right)^{\frac{1}{2}} = 185{\cdot}35$$

Total flow = 1115·59

As this is too much, try a smaller head, say = 100·25 feet

Then G from storage reservoir

$$= \left(\frac{(3 \times 12)^5 \times 100}{4 \times 1760}\right)^{\frac{1}{2}} = 926{\cdot}76$$

And G from service reservoir

$$= \left(\frac{(3 \times 12)^5 \times 25}{1760}\right)^{\frac{1}{2}} = 92{\cdot}68$$

Total = 1019·44

In view of the certain amount of error in all formulæ for the discharge of pipe, due to difficulty in ascertaining the exact allowance for pipe friction, this value may be taken as correct. The answer to part (1) of the question will therefore be: The pressure in the trunk main, at the connection with the distributing main, will be 450 – 100·25 = 349·75 ft. head $= \frac{349{\cdot}75}{2{\cdot}3} = 152{\cdot}1$, say 152·1 lb. per square inch. The answer to part (2) will be: The main from the storage reservoir will deliver approximately 926 gallons, and the main from the service reservoir the remainder—*i.e.*, 74 gallons. In answer to (3), the hydraulic gradient for the pipe line will be as shown in figure. (J. A. R., *Chatham.*)

HOUSING OF THE WORKING CLASSES.

"Some Conclusions on Housing our Workers" was the title of a Chadwick Public Lecture delivered by Mr. W. E. Riley, F.R.I.B.A., at the Royal Sanitary Institute, Buckingham Palace-road, on the 17th ult. Sir William J. Collins, K.C.V.O., M.D., chairman of the Chadwick Trustees, occupied the chair during the proceedings.

In his lecture, Mr. Riley referred at the outset to the principles which govern housing operations in large towns. Statutory restrictions require usually that, where areas are condemned as unhealthy, dwellings must be provided on the area or in its vicinity, this being due probably to the popular view that many deemed the working classes find it necessary to live near their work than actually obtains. The war has, however, produced a new set of circumstances. It became necessary to augment the staffs of some works and to create others, involving the employment of large numbers of workers. These establishments by their nature have to be situate in more or less sparsely populated districts, and the problem has arisen as to how to provide homes for thousands of employees, for whom it is vitally necessary that they should live close to their work. This could be done either by the erection of huge blocks of tenement dwellings or of cottages, and Mr. Riley expressed satisfaction that the German method of housing in block dwellings was not being followed. He quoted figures showing that, while the average number of inhabitants per house in London is about eight, in Berlin the number is now seventy-seven. The result of this overcrowding is that in Berlin the percentage of deaths from tuberculosis is half as great again as in London, and London has about 30 per cent fewer deaths of persons of from fifteen to twenty-five years of age than has Berlin.

Mr. Riley referred to efforts which had been made by the establishment of colonies for workers at Bournville by Mr. Cadbury and at Port Sunlight by Sir William Lever. These areas are laid out in an extremely generous manner, which none but merchant princes could hope to carry through.

The most recent large scheme is the public enterprise embarked on by H.M. Government to provide accommodation at Well Hall, Eltham, for workers at Woolwich Arsenal. An area of about 100 acres is being covered with cottages, of which there will be on the east side of Well Hall-road about sixty-five of the first class, 249 of the second class, 411 of the third class, and 212 of the fourth class, the last-mentioned being flats of the maisonette type. The areas are laid out with streets 40 ft. and 30 ft. in width, the latter being in contravention of the London Building Act, and Mr. Riley spoke of the retrograde step taken by a Government Department in creating narrow streets, and of the immense outlay which the ratepayers of London have met to improve the width of streets for the requirements of increased traffic, and to open up closely built areas. Mr. Riley described the accommodation to be provided, and pointed out that the financial phase of the experiment cannot be compared with that of other authorities, trusts and companies, as no details of cost are made known. The conditions under which the accommodation was required are exceptional, and result in the relation of rent to capital cost being disregarded. Where the Government provide the site and buildings, and the worker earns a wage considerably in excess of what he receives in peace time, questions of ability to provide adequate accommodation on a sound financial basis do not arise, but it will be one of the problems following the war whether such schemes can be made into satisfactory investments.

Mr. Riley spoke of the predominance of economic consideration in all normal housing operations, and stated that his experience was that the crux of the problem was the cost of the site. He pointed out how the commercial value of cleared sites in central districts has to be written down to a housing value, in the case of the Boundary-street area the reduction being from £131,670 to £62,010. He briefly described the clearances at Boundary-street and Tabard-street, and said it was undeniable that in clearance schemes in London the rates have had to bear considerable burdens, and he expressed the view that it is not practicable to rehouse in central districts, as the work should be done without some form of subsidy. Some clearances in such neighbourhoods will continue to be necessary, but Mr. Riley pointed out that property owners were taking practical interest in the problem. His Majesty the King had given a notable lead in dealing with the Duchy of Cornwall estate in Kennington. It was not on account of financial considerations alone, however, that endeavours should be made to draw the industrial population from crowded centres to spacious and healthier suburbs. Growing importance is being attached to abundance of light and air, and the effect of the sun's rays in destroying microbes is admitted. It is claimed that buildings should be so designed that the direct rays of the sun should penetrate through every part of living rooms. At the Housing Congress at Ghent in 1913, considerable criticism was levelled at the construction of model block dwellings in England, particularly at the enclosing of common staircases, the exclusion of sunlight, and the want of cross ventilation in tenements.

Such financial and hygienic difficulties do not arise in the construction of cottage homes, and Mr. Riley described the schemes of the London County Council for the development of estates at Totterdown, Norbury, White Hart-lane, and Old Oak Common. The work of the Local Government Board under the Town Planning Act was also referred to, and Mr. Riley finally asked which method of housing, having regard to environment and the physical and moral advantage to the family, the great sanitary reformer Chadwick would probably have chosen. He had long ago concluded that the weight of opinion must go with the suburban cottage, and he thought he would have had Chadwick's endorsement.

Somerset County Surveyor at the Front.—Captain Edward Stead, of the Royal Engineers, who in civil life is the county surveyor of Somerset, but is now "somewhere in France" engaged in road construction and repair, wrote recently: "We are still pecking away at the black, muddy roads. The men are working very well, and we do our best to increase their comfort. I am making stoves out of disused oil drums; they are being done in the fitting shops belonging to the steam rollers. You, no doubt read what Sir John French said about the Royal Engineers in his last despatch. We are included in the new Troop formations to which he refers."

Housing Schemes.—In the House of Commons on Tuesday, the President of the Local Government Board was asked whether he would publish a list of the housing schemes that had been sanctioned since the outbreak of war and of those that had been refused. In reply, Mr. Long said he was afraid that any such list would be misleading and would scarcely repay the trouble of preparation. Speaking generally, the Department had since March last been forced, owing to the restrictions on expenditure, to take the line that loans for housing and other purposes could not be sanctioned at the present time. An exception had been made in the case of munition areas where further accommodation was urgently required for the workers, and in some half-dozen cases terms had been arranged under which housing schemes would, he was glad to say, shortly be put in hand.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Bexhill T.C.—An expenditure of £1,378 has been sanctioned in connection with the isolation hospital.

Edinburgh T.C.—A committee has been instructed to report upon the plans and estimates for the proposed new generating station at Portobello.

Greenock T.C.—A scheme is being considered for the erection of a convenience for women at the Lady Alice Park.

Salford T.C.—The town council on Wednesday referred back a resolution of the Building and Bridges Committee for cleaning and painting the Palatine Bridge at a cost of £450, and the Broughton Bridge at a cost of £220. Economy at the present time and expert opinion against painting in winter were the main reasons given for disagreeing with the resolution.

Stoke-on-Trent T.C.—Alterations are to be carried out at the old pumping station at the Fenton works, at an estimated cost of £500, for the provision of a testing station and meter repairing centre for the gas department.

Westmeath C.C.—It has been decided to obtain the views of other county councils with respect to the suggestion for taking over the Peamont sanatorium as a national institution for the treatment of tuberculosis.

REFUSE COLLECTION AND DISPOSAL.

Glasgow T.C.—Information is being obtained as to the best types of electrically driven vehicles for refuse collection.

Newport (Mon.) T.C.—The new refuse destructor in Tweedy-lane has been formally opened. The building, which was carried out under the supervision of the borough engineer, Mr. H. Tremelling, cost £12,000.

ROADS AND MATERIALS.

Amesbury R.D.C. — The surveyor, Mr. J. T. Huxham, reported that he had received formal sanction to estimates of £2,682 for the repair of 1 mile of the Bustard road, and £947 for the repair of 700 yds. of the Bulford road. He remarked that the work on the Bustard road was proceeding slowly, owing to the railway being constantly closed to stone traffic.

Cardiff T.C.—The city engineer, Mr. W. Harpur, reported to the Parliamentary Committee on the proposed improvement in the Cardiff-road, Llandaff, from the junction with Pontcanna and Pencisely roads in the direction of Llandaff. The corporation proposal was to make the road 50 ft. wide, but the county council proposal was for a 40-ft. road near the junction and near the corner of Penhill reservoir, but from that point it would taper off to the present width of the road—namely, 26 ft. 6 in.—opposite Llandaff-place. Mr. Harpur expressed the opinion that the county council proposals in no way met the requirements of the case, nor did they anticipate future requirements. A tramway service was greatly needed to Llandaff, and a 50-ft. road was the minimum width in which a double line of tramways could be properly constructed. The city engineer and Sir John Courtis were appointed to meet representatives of the county council again on the matter.

Chesterton R.D.C.—The Road Board are being asked to sanction a grant of £2,000 for making up roads for military purposes.

Chippenham R.D.C.—It has been agreed to accept a supply of tar from the Cardiff Gas Company, at an increased price of 6s. per ton upon last year's quotation.

Denbigh C.C.—The Finance Committee reported that they had agreed to support the application of the Wrexham Rural District Council for a grant from the Road Board towards tar-spraying and tar-macadamising the various roads in the southern and northern division of the Wrexham rural district, amounting to the sums of £1,298 and £1,217.

Deptford B.C.—It has been agreed to pave certain horse shelters for the military authorities. The work will include about 28,000 sq. yds. of shelters, and 23,000 yds. of approaches.

Greenwich B.C.—The borough surveyor, Mr. Ernest J. Heward, has been authorised to construct a road for military purposes across a portion of Woolwich Common in the direction of Shooter's Hill. The whole cost of the work will be borne by the Army Council.

Hendon U.D.C.—The surveyor, Mr. S. S. Grimley, has prepared an estimate for making up the proposed main roads under the town planning scheme, No. 1.

Honiton R.D.C.—A letter was read from Mr. W. North, the surveyor, asking for an allowance in view of the increase of the price of petrol—viz., 5d. per gallon. Last quarter it cost him £10 for petrol to enable him to go over the roads in the district on his motor cycle. It was agreed to grant Mr. North during the period of the war an increase of salary to the amount of £5.

Isle of Ely C.C.—The report of the Highways and Bridges Committee showed a saving of about £4,000 on the maintenance of the main roads in the half-year ended September 30th. The chairman, Alderman C. Bidwell, said they were reducing the expenditure commensurate with keeping up the state of the roads. They had very fine roads throughout the Isle of Ely, and it would be false economy to allow them to decline. He believed, however, that they were keeping up the roads. In regard to the new military road passing through the county at Stretham, and crossing the Old West River and the Cam, the chairman stated that the work was getting on very well indeed, and when finished it would be an excellent road. The only cost to the county was one-third of the proposed bridge over the Old West River.

Kensington B.C.—It has been agreed to carry out an improvement in Fulham-road.

Londonderry C.C.—It was reported as being significant of the abnormal conditions now prevailing that of twenty-seven applications for road maintenance in Magherafelt district, involving 98 miles of road and a proposed expenditure of £2,065, only two roads were tendered for, embracing 5½ miles of road, at an outlay of £91.

Monaghan C.C.—The county surveyor, Mr. J. J. Hannigan, reported that over £4,900 worth of road works would this year be thrown on his hands in consequence of the failure of the rural council and county council to obtain contractors. It was decided to give Mr. Hannigan the assistance of a special committee in arranging what works should be done.

Perthshire C.C.—In his annual report to Highland District Committee on Saturday, Mr. J. S. Cree, road surveyor, stated that to keep the surface of the roads in good condition for existing traffic was causing the committee much anxiety. During the past four years large grants had been received from the Road Board, which had been chiefly expended in improving the main road to the North. Intimation had now been received that these grants were not likely to be continued, and if the roads in future were not to be allowed to deteriorate the assessment would either have to be increased or some means found of meeting the additional cost. It was suggested that owners of heavy motor vehicles who did not contribute anything towards road upkeep should be compelled to bear an equitable proportion of maintenance.

Preston T.C.—A sub-committee has been appointed to confer with the Estate Sub-committee with respect to the improvement of Fishergate Hill, consequent upon the erection of the new Penwortham Bridge. The council also resolved that all cobble-paved streets, when repaired in future, should be racked with gravel and grouted with pitch and creosote oil.

Radstock U.D.C.—Permission was given the surveyor, Mr. G. H. Gibson, to purchase from a South Wales quarry 500 tons of road stone for the main roads, the price quoted being 11d. per ton in advance of the price last year.

St. Germans R.D.C.—The surveyor, Mr. K. J.

Foster, has been instructed to prepare plans and estimate for making up Molesworth-terrace, Millbrook.

Shoreditch B.C.—It has been decided to obtain two motor road-sweeping vehicles, at a cost of £671 each.

Winchcombe R.D.C.—The surveyor, Mr. E. G. Whitcomb, reported that he had been unable to obtain any more stone, and he was instructed to obtain 250 tons from the Clee Hill Company. Their stone was rather more expensive, but the firm stated that they could promise early delivery.

SEWERAGE AND SEWAGE DISPOSAL.

Branston R.D.C.—The council have adopted a scheme providing a temporary arrangement for disposal of sewage at Boultham, a suburb of Lincoln, at a cost of £350. The scheme will meet the requirement for five years, and will delay the expenditure of £46,000, which it was estimated the original scheme would cost.

Chester-le-Street R.D.C.—The council are seeking sanction to a scheme for constructing a main outfall sewer into the tidal parts of the river Tyne.

Eastry R.D.C.—Mr. H. C. H. Shenton, Westminster, has been instructed to prepare plans for a set of contact beds at the Ash sewage disposal works.

Prestatyn U.D.C.—The council having applied to the Local Government Board for permission to borrow £20,000 for the provision of new sewerage works, the board have replied that they are prepared to hold an inquiry, but they point out that the amount applied for exceeds the margin of borrowing powers under the Public Health Act. It has been decided to inform the board that it is the intention of the council to carry out the scheme in sections extending over a number of years, and that therefore the margin of borrowing powers would not be exceeded, as the assessable value of the district is increasing yearly.

Sandgate U.D.C.—The surveyor, Mr. D. V. Howard, has been asked to prepare a further report of the proposed scheme of flood prevention.

Wigton R.D.C.—A scheme has been adopted for the extension of the sewers to the west-end of the village at Hayton.

WATER, GAS, AND ELECTRICITY.

Axbridge R.D.C.—The council are giving consideration to a scheme for the construction of a reservoir for the Winchcombe and Shipham water supply, at a probable cost of from £3,000 to £5,000.

Bingley U.D.C.—It has been decided to carry out water main extensions in Ireland-terrace.

Gloucester T.C.—The borough surveyor, Mr. R. Read, has submitted three tenders for providing and laying water mains, and the council are recommended to accept the tender of Messrs. Hobrough & Co., the lowest, amounting to £2,648, for providing and laying 6 in. and 4 in. mains as specified. The council are also recommended to apply to the Local Government Board for sanction to borrow that part of the capital cost of the extension which is not contributable by those interested in the supply.

Halstead R.D.C.—Consideration is being given to a water supply scheme at Castle Hedingham, which is estimated to cost £770.

Rotherham T.C.—Official sanction has been given to the purchase of a 5,000-kw. alternator set at the electricity works.

Stoke-on-Trent T.C.—The Gas Committee reported that at the close of the last financial year the Burslem works had a balance of £4,370 to the credit of the nett revenue account, but that considerable expenditure was needed at these works which would absorb the greater portion of the balance if the risk of breakdown and stoppages were to be avoided and efficiency maintained. The estimated cost of the work was £3,750, and the council agreed to the adoption of the scheme outlined by the engineer as essential to the satisfactory working of the undertaking.

Street U.D.C.—The surveyor, Mr. W. G. Goode, has discovered several defects in the main supply pipe from Rodney Stoke to the reservoir, and he recommends an examination of the main with a view to saving a large outlay in relaying the pipes later on.

MISCELLANEOUS.

Amesbury R.D.C.—The sanitary inspector reported that complaints had been made about the water supply in Edward's-road, Amesbury, and there was an application for the sewer to be extended in the same road. There was great difficulty in disposing of the sewage at present. He was compelled to refer again to the necessity of a public water supply and some system of house-to-house refuse collection for Amesbury. Under the present system serious nuisance and pollution of water was bound to occur, with blockage of drains, &c., and inspections only became a farce, and useless. The medical officer, Dr. Beard, said he had not the slightest hesitation in stating that the water in Amesbury was certain to be polluted. He quite agreed with the sanitary inspector that it was advisable to have some system of house-to-house refuse collection. The gardens were small, and people just threw the stuff there. It did not need any remarks from him to say that the refuse, being allowed to be there and rot, was bound to be bad for the public health. The question of a house-to-house collection was referred to the Amesbury Parish Council, the chairman explaining that the matter of the water supply would be considered at a subsequent meeting.

Clacton U.D.C.—Acting upon the advice of the surveyor, Mr. D. J. Bowe, the council have decided to put a new apron in front of that already existing from the jetty groyne to the council's boundary, at an estimated cost of £240.

Hampshire C.C.—The council have accepted the tender of the United Water Softeners, Limited, for the supply of water softening plant at the asylum, and a loan of £16,500 is to be taken up for the provision of electrical plant.

Isle of Ely C.C.—A resolution was adopted recently pressing upon the Board of Agriculture the urgency and grave importance of the promotion of a Provisional Order in Parliament similar to the Ouse Provisional Order, 1915, setting up a new authority or empowering an existing authority, with powers in regard to the navigation, taxation, and administration, and for the better drainage and embanking of the river Ouse and its tributaries. It was stated that there was at present a length of main river over which no authority had any jurisdiction.

St. Ives T.C.—The necessity for drawing up definite instructions with respect to transactions which are left to officers was instanced in the case of a concrete mixer which the council offered for sale. It was stated that an offer had been received, but that it had been missed because no price had been fixed. Alderman Pearce understood the position was that the surveyor was to advertise and submit the offers to the committee. Had he received an offer which he felt would have been perfectly satisfactory to the committee, no doubt he would have accepted, but inasmuch as there was some doubt about the price offered for the mixer, he consulted two or three members of the council, and in consequence the acceptance was a little delayed and was too late. He thought the principle of consulting the committee where a definite price had not been fixed was a good one. Councillor Jame said he was rather afraid a fair price for the mixer had been lost.

Newport Fire Station Extension.—The opening has taken place of the enlarged fire station at Newport (Mon.), which involved an expenditure of about £4,000. The plans were prepared by Mr. C. F. Ward, borough architect.

The City of the Future.—The city of the future was described at the meeting of the Northern Architectural Association, Newcastle, by the president, Mr. R. Burns Dick, F.R.I.B.A. He indicated what might be the effect upon the construction of cities by the greater development of aircraft. Among the possible changes, he thought, would be a gradual increase in the proportion of open spaces; the general introduction of underground or double-decked roadways; tiled and slated sloping roofs entirely abandoned in favour of very strong flat roofs specially adapted for anti-aircraft appliances; picture galleries with suspended wall linings on which the pictures would be fixed, and which could be swiftly dropped to their safety vaults below; museums with their cases of treasure, statuary, &c., arranged on continuous lift platforms capable of being lowered by the pressing of a button; and schools and similar buildings so modified as to make them immediately available for the accommodation of the citizen in arms at the signal of alarm. He could also imagine a network of subways linking up important centres and permanently constructed and well-equipped trenches protecting the great industrial centres; and great electric generating stations entirely underground.

PERSONAL.

Mr. J. S. Cooke, district surveyor of Loddon, under the Eastern Highways Committee of Norfolk, has joined the Army.

Mr. C. G. Atkinson, temporary surveyor to the Chertsey Rural District Council, has announced his intention of enlisting.

Mr. F. W. Floyd, Rockhampton, has been appointed road surveyor for the Berkeley district under the Thornbury Rural District Council.

Mr. R. H. Kilburn, surveyor and sanitary inspector to the Guisborough Urban District Council, has been granted leave of absence to join the Army.

Mr. J. E. Hattersley, surveyor to the Saxmundham Urban District Council, has been appointed borough surveyor of Buckingham, at a salary of £150 a year.

Mr. E. W. Lees, district surveyor for St. Pancras North, has been appointed interim district surveyor for Stoke Newington, in place of Mr. J. D. Matthews, resigned.

Mr. W. H. Eley, ASSOC.M.INST.C.E., was last week erroneously stated to have taken up a commission in the Royal Engineers. We understand that he has applied, but has not yet received it.

Messrs. F. Lowis and T. Tingle, surveyors to the Louth Rural District Council, have been granted permission to join the Colours. The council have agreed that their Army pay shall be made up to their present salary, and their positions kept open.

Mr. L. W. Pye, who has been for some years in the Cleethorpes Urban District Council surveyor's department, has quite recently become an associate by examination of the Institution of Civil Engineers. He is now the acting engineer and surveyor to the council.

Sir John Benn, ex-chairman of the London County Council, mentions, in the course of an interesting interview with a representative of the *Weekly Dispatch*, that in the service of the London borough councils there are "twenty-nine surveyors, with, of course, a due setting of subordinates." He also notes that the collection and disposal of street refuse and gully slop costs in St. Pancras 11s. 8d. per ton, in Kensington 20s. 10d., and in Westminster 42s.

Mr. Thomas Henry, surveyor to the East Retford Rural District Council, has two sons in the Army. One of them, Cyril, was notified of his commission as surgeon dentist on the 18th ult., on the 20th he returned home in uniform, and on the 25th he was at the Front. Lieutenant Henry had just completed his time as house surgeon in the Royal Dental Hospital, Leicester-square, W.C., and was previously at the Westminster Hospital. Mr. Henry's second son, F. A. Henry, is a midshipman in the Royal Navy on H.M.S. "New Zealand," and is at present home on leave.

Mr. E. H. Bennett, engineering assistant in the borough surveyor's department, Derby, has been accepted in the Artists' Rifles O.T.C., with a view to obtaining a commission in the Royal Engineers, and two other members of the professional staff, Mr. Cyril Slater and Mr. W. F. Gardner, have also joined the Royal Engineers. The following additional members of the clerical staff have enlisted—viz., W. Fearn, S. G. Potter, A. E. Lee and L. Brown, North Mid. R.A.M.C.; R. Piggin, Derbyshire Yeomanry; F. Allsop, North Mid. Howitzer Brigade; J. Gull and C. W. Turpie, Seaforth Highlanders; and R. Spencer, Royal Fusiliers. The total number enlisted since the commencement of the war out of a staff, including four temporary men, of twenty-four, is sixteen, or practically 66 per cent.

Mr. W. H. Gladwell, district surveyor for the East Harding Division of Norfolk, was on Saturday appointed county surveyor temporarily during the war, in succession to the late Mr. T. H. B. Heslop, at a salary of £300 a year, with travelling and other actual expenses. Mr. Gladwell, who is forty-six, has been in the service of the county council for nearly twenty-two years. He was the trusted assistant of the late county surveyor in many important ways, and his record is extremely good. Further, at a meeting of the district surveyors, lately held, it was resolved that if Mr. Gladwell made application for promotion in the service of the county and his services were accepted, the district surveyors would give him their most loyal support. Mr. Gladwell was for three years with a contractor, and had exceptional opportunities of obtaining good practical experience of building and constructional work generally. He served three years' articles with Messrs. Sheldon & Walsh, surveyors, of Macclesfield. While with this firm he was engaged on many important surveys, and on drainage works, opening up estates for building purposes, and the construction of new roads. He had charge of the surveys and sections of a 20-mile length of the proposed Lancashire, Derbyshire, and East Coast Railway. He was then appointed assistant surveyor to the Prestbury Highway Board, and remained there two years in the management and control of 62 miles of main roads, 250 miles of district highways, and numerous bridges. He prepared drawings for several new bridges, and had the superintendence of the construction of them, and was also employed on considerable road improvements. He left Prestbury to take up the position of assistant to Mr. C. F. Marston, borough engineer and surveyor of Sutton Coldfield, and for eighteen months was employed on the preparation of drawings, specifications, and quantities for 3 miles of new streets and extensive sewerage works, of the construction of which he had sole charge, as well as carrying out the routine work of a borough surveyor's office. He vacated this position in 1894, when he secured the post of district surveyor to the East Harding Division. At the same meeting at which Mr. Gladwell's appointment was confirmed, the county council voted a sum of £200 to Mrs. Heslop, widow of the late county surveyor.

OBITUARY.

Mr. John Dolan, late deputy surveyor for County Roscommon, who resigned recently, died last week, we regret to state.

NUISANCE FROM POWER STATION.

ACTION AGAINST DISTRICT COUNCIL.

In the Chancery Division, on the 18th ult., Mr. Justice Neville heard the case of *Dexter* v. *Aldershot Urban District Council*, in which the plaintiff, the owner and occupier of Cargate House, Aldershot, sought to restrain the local authority from so running and working their electrical plant and water tower as to be a nuisance.

Plaintiff's complaint was that the vibration and noise caused by the working of the engines and machinery seriously interfered with the comfort and enjoyment of her house, and that the large quantities of steam and vapour which were emitted from the water tower penetrated into her house and rendered it damp and unhealthy and unfit for occupation.

His lordship, after hearing evidence, came to the conclusion that the noise and vibration complained of amounted to an actionable nuisance, but that the evidence as to a nuisance arising from the water tower was very slight. He granted the injunction asked for against noise and vibration, but having regard to the war he stayed the operation of the injunction until three months after the declaration of peace.

Dundee City Hall.—The Chancellor of the Exchequer was asked in the House of Commons on Tuesday whether, in view of the fact that the work on the new City Hall at Dundee was still being actively proceeded with, he could see his way to publish the full correspondence on the subject which had passed between himself and the Lord Provost of Dundee and Sir James Caird. Mr. Montagu, who replied, said his right hon. friend had communicated with the parties concerned and they had not seen their way to assent to the publication of the correspondence for the present.

FOR OTHER ADVERTISEMENTS
See End of Paper.

SOWERBY BRIDGE URBAN DISTRICT COUNCIL.

The above Council invite Tenders for the Supply of 145 yds. of Wrought-iron and Steel Fencing, Gates, &c. Further particulars may be obtained from Mr. Jas. Eastwood, ASSOC.M.INST.C.E., Surveyor, Council Offices, Sowerby Bridge.

Sealed Tenders, endorsed "Tender for Fencing," to be sent to the undersigned on or before December 18th, 1915.

LEWIS RHODES,
Clerk to the Council.

Commercial Bank Chambers,
Halifax.
December 1, 1915. (2,783)

Harbour and Coast-Defence Works at Alexandria, Egypt.

By DAVID ERNEST LLOYD-DAVIES, M.Inst.C.E.

[The paper of which the following is an abstract was read on Tuesday at a meeting of the Institution of Civil Engineers.]

The city of Alexandria possesses two harbours. The former, which is under the jurisdiction of the Ports and Lights Administration of the Egyptian [illegible], which is being developed by the municipality, is at present only available for light-draught and pleasure craft.

After brief allusion to the history of the city, the paper describes the development of the Western Port under Mohammed Ali Pacha, Said Pacha, and Ismail Pacha. The important scheme of development decided upon by the last, which was designed by Mr. Linant de Bellefonds, the Minister of Public Works, included the construction of the breakwater from Ras-el-Tin point, the construction of the principal coaling jetty, and the construction of quays, having a total length of 2,950 yds., between the main coaling mole and the old careening basin, embracing the reclamation of 305,000 sq. yds. of frontage. The total cost of the scheme amounted to £3,011,400, though the value of the reclaimed land was estimated at [illegible].

The first improvement of the access to the part was undertaken in 1889, and consisted in the deepening and widening of the Boghaz Pass, the only fixed channel. High and low lighthouses were built to give the leading line at night, the higher light being visible for a distance of 10 miles.

In 1900 the Gabbary dry dock was built by the Khedivial Mail Steamship Company, after the designs of Sir Benjamin Baker.

In 1893 the western extension of the quay, south of the old careening basin, was undertaken.

The general expansion of commerce in the port and the consequent lack of quay-space rendered imperative the removal of the timber trade, which had increased in value from £288,000 in 1884 to £1,337,000 in 1907, to a more convenient site. For the quays and storage sheds an area of about 420,000 sq. yds. of land was reclaimed and levelled, and three moles, each 131 yds. long and 87 yds. wide, 60 yds. apart, were constructed. The depth alongside is 30 ft., and the quay frontage 1,225 yds., which will allow nine ships to be berthed at one time in case of necessity. The works were completed in 1911 at an outlay, inclusive of road paving, drainage, expropriation, and administrative charges, of £282,770, or roughly £50,000 less than the value of the lands reclaimed. The main breakwater and the quarantine jetty were also extended to protect the timber quays.

The breakwater extension was built on a sea-bed of silt by the Croizette-Desnoyers system of penetration.

The contract for the two moles was executed by Messrs. Edward Almagia & Sons in twenty-seven months. The total expenditure was £217,900, and the work was completed in 1908, but the damage done to the seaward face of the moles has shown that:—

(1) The face blocks should have been carried to 33 ft. instead of 16 ft. below low water. This has been remedied by laying additional blocks at a cost of £20,000, to protect the slope, which had been flattened by sea action to 3 to 1.

(2) The upper part of the structure on the harbour side was not stable enough to withstand the impact of the falling water. This defect is being got over by encasing the exposed rubble in masonry.

It has been found that portions of the breakwater which lie opposite the openings between a series of submerged reefs some distance out on the sea side are more attacked than others.

The quays south of the old careening basin were lengthened and widened at this time, and a reinforced-concrete stores was built.

Mr. Malaval, previously chief engineer of the Ports and Lights Administration, applied his adaptation of the Croizette-Desnoyers system with much success. The method consisted of tipping selected filling over a breadth considerably more than the base of the finished section. The tipped mound was carried up to a sufficient height to force the filling into the unstable ground, the filling being continued until it was stable at ground level, and subsequently a considerable surcharge was added over and above the finished level of the work. After absolute stability had been obtained with the surcharge, the surplus material was removed and the work was completed to the designed levels. The author has applied this system with encouraging results for carrying a main outfall sewer embankment over ground which would not carry the weight of an average man.

A small jetty, with a depth of 23 ft. alongside, has lately been constructed in reinforced concrete on the caisson principle. A beacon on the Grand Pass was recently constructed on the same principle and floated into place.

The western port of Alexandria now ranks third, after Marseilles and Genoa, among the Mediterranean ports, and its 1,850 acres of sheltered area are capable of accommodating 250 large vessels 100 yds. apart. The total tonnage of the ships entering and leaving the harbour increased from 2,052,000 tons in 1880 to 7,814,000 in 1908, while the value of import and export trade rose from £18,856,000 to £52,075,000 during the same period. The revenue in 1911 reached £325,000.

THE EASTERN PORT

The deplorable condition of the foreshore in the eastern harbour, owing to the direct discharge of sewage into the bay, induced the Alexandria Municipality in the early 'nineties to consider proposals for the amelioration of the existing state of affairs.

It was finally decided:—

(1) To construct a promenade with a sea-wall, of suitable design to resist the roughest sea, around the eastern harbour, and to lay a main intercepting sewer along its entire length, with outfalls at both Kaid Bey and Silsileh.

(2) To abandon any idea of building breakwaters to protect the harbour.

(3) To construct a promenade with a sea-wall and intercepting sewer around Anfouchy Bay.

The promenade has an overall width of 95 ft., divided into two carriageways, a central platform, under which are laid the main intercepting sewer, gas and water mains and electric cables, and inner and outer footpaths.

Mr. Quellennec, who was consulted as to the sea-wall sections, advised the adoption of three types.

The first, for the most exposed positions, consisted of an embankment of loose graded stone resting in the mixture of mud and sand on a dredged foundation, and was faced with 17-ton concrete blocks offsetted to a slope of 45 deg. The masonry walls rest on the mass.

The second and more economical section, built with a vertical face, was made use of where the depth did not exceed 10 ft. It was judged necessary, however, during the progress of the work to strengthen the toe by the addition of a rubble apron graded to a slope of 1 to 1, and composed of stones ranging in weight from 1 to 2 tons. The apron extended from water level.

The third section was chosen for the western side of the bay, which is protected by the Kaid Bey promontory, and where the depth of water varies only 2 ft. to 5 ft. It is composed of a simple rubble mound, 8 ft. wide at the top, with an outer slope of 1 vertical in 3 horizontal, and an inner slope of 1 in 1, supporting a dwarf masonry wall.

The whole undertaking was carried out in the years 1900-4, at a cost of £377,000, inclusive of the intercepting sewers and the filling of the 630,000 sq. yds. of reclaimed land. The total cost was approximately £500,000. By the sale of reclaimed land the enterprise would have yielded a profit of at least £500,000 had all gone well; but, unfortunately, the violence of the sea had been underrated, and the waves during stormy weather washed over the sea-wall, inundating the promenade and adjacent property.

The author, who was appointed city engineer of Alexandria in the autumn of 1906, was instructed to report on the matter. Investigation revealed the fact that a portion of the toe of the section had

been scoured out in the most exposed places, and that the 17-ton blocks had slipped forward. The impact of the waves hurled huge masses of water to a height of 26 ft., and the force of the blow was calculated to be at least 1·56 ton per square foot. The whole of the additional apron of 1-ton to 2-ton stones in front of the vertical section was washed away, and the masonry was attacked, while the air compressed by wave action drove jets of water through the mound (the lightest of the three sections) to a height of 3 ft. in the roadway. Evidently, therefore, the initial error was the omission of the breakwater.

Three alternative remedies were proposed:

(1) The construction of breakwaters at the mouth of the bay, at a cost of £220,000.

(2) The construction of smaller breakwaters within the bay, at a cost of £180,000.

(3) The addition of a long rubble bank gently sloping towards the toe of the wall to reduce the velocity of the breaking waves, at an estimated expense of £130,000.

The first alternative was chosen, as it served the triple purpose of protecting the sea-wall, creating a fine pleasure harbour 600 acres in extent for the city, and providing an additional refuge for light commercial craft, which appeared quite to justify the additional expenditure. The length of the Kaid Bey Branch is to be 547 yds., and average depth of water 26 ft.; the Silsileh arm will be 765 yds. long in 16 ft. of water. The width of the entrance will be 383 yds., and the depth 30 ft. The foundation consists of hard sand.

The section is an adaptation of Pascul's Marseilles composite type, with the outstanding feature of a double slope, 1 in 1 up to water level, and afterwards 1 in 3 for the pell-mell blocks on the exposed face.

The pell-mell and set blocks, weighing 40 tons, are composed of 5 parts of broken limestone, 2 parts of sand and 1 part of hydraulic lime. The variation allowed for the voids in the pell-mell mass is between 25 per cent to 35 per cent, to give an average of 30 per cent; special precautions with regard to the first course of blocks were taken to lay them accurately endways at the toe, in order that they should offer as small a face as possible to the impact of the sea.

It was decided to undertake the Kaid Bey branch first, and Messrs. Schneider & Company have the work in hand.

The storm conditions at Alexandria vary from year to year to a remarkable extent, so that, by fortuitously encountering a bad year, the contractor might be unjustly penalised; to avoid this it is agreed that any day during which the wind blows for any complete hour with a velocity exceeding 15 miles per hour, no matter what the direction may be, is to be regarded as a *dies non*.

Under the author's main drainage scheme for the city, on which £350,000 will be ultimately expended, all sewage is to be conveyed to a pumping station at Kaid Bey, and discharged ½ mile out to sea at Y, the depth of water at that point being 82 ft., and the set of the tidal current being westward. The present outfalls will, under the new conditions, be utilised as storm-water outlets only.

STABILITY OF BREAKWATERS.

The methods employed for the estimation of the strength of breakwaters seem in many instances to be shrouded in mystery. Prof. Luigi Luiggi has lately discussed the stability of the breakwaters of thirteen different harbours of the world, and has traced a pressure-curve for waves of translation which is adaptable to a dynamic or breaking wave of 20 ft. to 25 ft. in height, with the maximum pressure at ordinary sea level of 2·79 tons per square foot. This height of wave and consequent pressure is not the greatest met with, but the curve can be modelled to meet the conditions of the locality.

The critical positions lie between the depths of 12 ft. and 33 ft.—*i.e.*, where the rubble mounds of composite breakwaters generally end and the superstructures begin—and many disasters have been caused by the employment of insufficiently heavy material for the rubble at this point, or the adoption of too steep a slope.

The Luiggi curve can be also utilised for calculating the resistance of a breakwater against overturning and against displacement, or sluing.

In conclusion, attention is drawn to the notable advantages of the employment of huge reinforced-concrete caissons filled with concrete so as to produce one monolithic mass in the construction of breakwaters.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not rather to be regretted that the *Autocar* still presses for some change in the attitude of the Government towards the Road Board funds? Is it not evident that unless all our energies and all our money are devoted to one object—viz., the utter defeat of our enemies in the shortest possible time—this country will be sadly crippled financially hereafter? Do many of us realise that the present cost of the war to England is about £3,000 a minute! and is likely to increase?

* * * *

Owing to shortage of timber in this country and the difficulties of importation during the present crisis, should we not cast about for supplies from other sources? What about Japanese oak, of which we have heard a good deal lately? Is it not quite as good, for many purposes, as that from Austria, and should we not be helping a friendly country by using it?

* * * *

Should not Mr. Wakelam, the county engineer of Middlesex, be congratulated on the success which has attended his design and erection of the new court house at Ealing? Was it not a well-deserved compliment that Mr. Luke paid him, in handing over the court to the Brentford magistrates, when he said that no architect in the country had greater experience of work of that kind than Mr. Wakelam, and that it was a building that would challenge comparison with any court house in the kingdom?

* * * *

What is going to happen in London and in other large cities if there should be a heavy fall of snow? Is it not a fact that, owing to shortage of labour, the authorities will be unable to deal with it, and that it will rest with the householders themselves to shovel away the snow from the footpaths opposite their premises? Would it not be well if householders were furnished with instructions as to the proper method of doing this work; otherwise is there not a possibility that our roads will become impassable?

* * * *

Is it not a rather curious ramification of the dislocation caused by the war that the Bermondsey Borough Council should have got into trouble with regard to their method of disposing of rotten eggs? Will it not be regretted by some ardent politicians that these eggs cannot be kept for the "piping times of peace"?

* * * *

Is there not considerable truth in an article on "National Waste in Life" in the September number of "Constitution Papers," in which Mr. Flinders Petrie, the eminent Egyptologist, gives instances of the general waste of time by workmen of the present day, and says that "this deliberate waste of the greater part of their lives is dragging down this country worse than any war," and that "unless we get rid of this incubus of artificial training in sloth we shall deserve to perish as a nation"? Is it not a fact that, with individuals as well as with nations, unless the best efforts are put forth, decadence is bound to result? What will be the result of this war unless the nation puts forth its best efforts in every direction?

* * * *

Is it not remarkable, and does it not show that the housing question is well understood in the city of Liverpool, when we read that the workmen's dwellings under the control of the corporation amount to the large number of 2,792, and that of these only ten are vacant? Is it not also interesting to find that 11,393 persons occupy these dwellings, or about four persons per dwelling? Would it not be of further interest to know how many persons per room this means, or what are the restrictions with regard to possible overcrowding?

* * * *

Are we fully realising the necessity for economies? Is there not still a tendency to go on as usual? Why, for instance, is it necessary for medical officers of health and surveyors to publish long and elaborate annual reports, which are sometimes very costly productions? Was not the Rugby Urban District Council justified recently in calling the attention of the Warwickshire County Council to the great expense incurred by that body in the preparation, printing, and circulation of the report of the county medical officer of health? Is it not time that some limit should be placed on these literary luxuries?

CONCRETE INSTITUTE.

PROF. HENRY ADAMS' PRESIDENTIAL ADDRESS.

At a meeting of the Concrete Institute held last week at Denison House, Westminster, Prof. Henry Adams, M.INST.C.E., M.I.MECH.E., F.S.I., F.R.SAN.I., delivered his second presidential address to the members of that body.

In opening, Prof. Adams remarked that it had been a year of anxiety, but he was happy to say that so far the institute's membership and funds had suffered no material loss. Many of their members were serving with the Forces, but they had had a record number of meetings, which had all been well attended.

REINFORCED CONCRETE REGULATIONS.

The labours of the council of the Concrete Institute in the matter of the Reinforced Concrete Regulations, extending over a period of six years, had at last borne full fruition. In the draft of the regulations, [illegible] was submitted to the country for final approval before they became law, the whole of the council's recommendations were found to have been adopted, with very slight modifications here and there. Very prolonged attention and a considerable amount of thought and anxiety had been devoted to the subject, and the result was one of which the institute might justly feel proud. Reinforced concrete construction carried out in accordance with these regulations would be absolutely safe, and, so far as could be judged at present, its effective life would only be measurable by centuries.

A YEAR'S WORK.

Although this has been one of the most eventful years in the history of the world, there was not very much to chronicle in the domain of reinforced-concrete construction.

A most unusual piece of engineering construction was nearing completion at Baltimore. The work consisted essentially of converting an old brick-lined water tunnel, in which the flow was by gravity, into a pressure conduit operating under a head of 35 lb. per square inch. The novelty lay in the use of huge separately moulded reinforced-concrete pipes, the largest having a diameter of 9 ft., to form the new tunnel lining. As the existing tunnel was only 12 ft. in diameter, it was clear that the work had to be carried on in cramped quarters, and, in addition to the difficulties inherent in placing 10½-ton sections of pipe with so little working room, there was the obligation of shutting down operations every few days and using the conduit to deliver water to the city. The valves were then closed and the tunnel drained in order to allow the work of lining to proceed. One of the features of the construction was a specially designed car, which carried the ponderous pipes into the tunnel, and by means of adjusting equipment set them accurately to line and grade. The concrete pipes were of particular interest, for they were claimed to rank among the largest precast units ever built. It was also unusual to use reinforced concrete to resist such a great internal pressure as was found in the Baltimore tunnel conduit.

Prof. Adams went on to observe that in the reconstruction of the numberless bridges on the Continent destroyed by the war, reinforced concrete would no doubt be largely used. It was a fine opportunity, and he hoped some of their members would, later on, be able to give them a good paper on the subject. A reinforced-concrete bridge at Soissons was blown up by the Germans in their retreat from that town, but, owing to the great strength and toughness of the material, it defied all attempts at complete destruction, such as was readily effected in the case of the other bridge at Soissons, which was of metal. The former still crossed the river after a fashion, and gangways laid over the ruins gave access to both sides.

"DUSTING."

An American engineering journal had recently asked why it was that in two concrete buildings apparently constructed under identical conditions, built by contractors of equal intelligence and integrity, from concrete composed of similar aggregates and the same brand of Portland cement, the floors in one would turn out hard, firm, and resistant to abrasion, while in the other ordinary usage would result in dusting. The fact that numerous dustless concrete floors had been laid seems to indicate that the trouble must lie in the selection, proportioning, mixing, placing, or finishing of the material. The procedure and proportions described below had given excellent results. For first-class work a rich mixture was desirable, say one in which the aggregate consisted of granite, or other hard stone, screenings graded from ¼ in. down to the finest, and crushed stone of equal quality passing a ½-in. ring and retained on a screen having ¼-in. mesh. All trowelling and finishing of the floor surface should be completed within two and a-half hours from the time the materials left the mixer. This necessitates mixing the material to such consistency that the mortar had to be scraped from the wheelbarrows, and could hardly flatten out when dumped upon the floor wet enough so that it could be "struck off" with little difficulty when spread out with shovels. The floor usually was in a condition to be trowelled for the last time within an hour and a-half or two hours after the finishing course had been mixed. When sufficiently hardened to prevent pitting, the floor should be sprinkled with water until 2 in. of sawdust could be thrown on the surface without injury. The sawdust should be thoroughly wetted and kept moist by sprinkling for a period of two weeks.

A mixture of 15 or 20 lb. iron dust with 100 lb. Portland cement added to twice that quantity of sand applied as a top coat 1 in. thick to a concrete floor was said to render it hard and durable.

What might be called the standard mixture for concrete in reinforced work was 1 part Portland cement, 2 parts sand, and 4 parts larger aggregate, by volume, commonly known as a 1:2:4 mixture. There was a very objectionable practice on the part of some people, who ought to know better, to call this a 1 in 6 mixture, with the result that a builder might have some ground for assuming that he complied with the requirements by using 1 part of cement to 6 parts of combined sand and larger aggregate, which would approximately be a 1:3:6 mixture; but there was no guarantee of the proportion unless the materials were mixed separately, 90 lb. of cement being taken as equal to 1 cub. ft.

COKE-BREEZE CONCRETE.

In a curious case that came to his knowledge gas fumes were given off from some coke breeze-concrete floors. The cause seemed to have been that the coke breeze was not completely carbonised before being used, and the gas left in it was liberated by the action of the lime pugging filled in between the flooring fillets. The smell was always stronger on humid days; this was accounted for by the pugging being able to hold a considerable amount of moisture and so increasing the chemical action. It was another illustration showing the wisdom of following the advice of the Concrete Institute, and not using coke breeze concrete at all.

FAILURES.

Continuing, Prof. Adams said that, in view of the remarks upon failures of concrete structures in his last address, a paper read by Mr. R. S. Greenman before the American Society for Testing Materials was particularly interesting. Mr. Greenman stated that the causes approximated to 90 per cent due to poor workmanship, 8 per cent to poor aggregates, and 2 per cent to poor cement. Fortunately, the larger the work the greater the care that was taken, so that the failures chiefly lay with the smaller and less important constructions. He gave instances of failure due to impure water, sand, and stone, all of an exceptional character, and for that reason more liable to escape attention. He considered the failures due to poor workmanship to be so common as not to need detailed examination, and summarised the chief appearances of improperly mixed concrete. In conclusion, he recommended both laboratory tests and field inspection, so that the conclusions of the investigator might be founded upon a consideration of the failure from every point of view, whether the object of the examination was to place responsibility or to guard against future failures. From the engineer's point of view the latter was the sole point of interest.

The time had gone by when engineers were justified in regarding their knowledge of how to do things as professional secrets. Looking at the matter strictly from the standpoint of individual selfish advantage, and not that of professional welfare, it was not desirable to have the same mistakes repeated. Engineers were not usually retained by other engineers, but by men without technical knowledge. These men, learning that certain kinds of work or certain classes of plants had not been successful, were naturally prejudiced against them,

and looked with suspicion on the advice of any engineer on such subjects. The best way to have the engineering profession straightened was to prevent inferior or bad engineering work, and the best way to accomplish that was to tell freely what proved successful and what proved unsuccessful, so that everybody might profit, so far as in him lay, by the knowledge of all. No engineer would lose standing among his colleagues or be ranked any less competent by business men for frankly putting on record a statement of his non-successes. On the contrary, he would receive the approbation of all thinking men, for he would warn others away from a repetition of his unsuccessful work, which was a most desirable thing.

In Mr. Greenman's paper they read among the opening remarks, "Concrete is said to be its own best inspector, and it is a well-known fact that defects in concrete will sooner or later make their presence known." Now, he did not think much of an inspector who only made defects known when it was too late to remedy them, but the important point was that defects would show themselves sooner or later. Mr. Greenman went on to say, "For every fault there must be a reason." That sentence ought to be taken as "the text" by their Investigation Committee, and no case should be allowed to rest until the "reason" or primary cause was found. They must not be discouraged if they were unable to learn as much as they would wish. One of the greatest men who ever lived, Sir Isaac Newton, when congratulated by his friends upon the extent and greatness of his discoveries, replied: "I know not what the world will think of my labours, but to myself it seems that I have been but as a child playing on the shore, now finding some brighter pebble, now some more variegated shell, while the vast ocean of truth lay unexplored before me."

A vote of thanks was accorded to Prof. Adams for his address on the proposition of Sir Henry Tanner, C.B., I.S.O., F.R.I.B.A., seconded by Mr. E. Fiander Etchells, ASSOC.M.INST.C.E., HON.A.R.I.B.A., and supported by Mr. O. C. Hills, F.R.I.B.A., district surveyor for the Strand.

SHEFFIELD CITY ENGINEER'S REPORT.

SCHEMES IN ABEYANCE.

The necessity for curtailing expenditure in view of the circumstances arising out of the war has compelled the Sheffield City Council to cancel the commencement of many important schemes. Of those works in this connection which would ordinarily now have been in hand, the following chiefly concern the department of the city engineer, Mr. Charles F. Wike, M.INST.C.E.—viz.:

Sewage works extension (secondary treatment scheme)	£70,000
Widening of Leppings Bridge	6,900
Public conveniences	1,754
Bowling-green pavilions	1,000
Abattoirs, sidings and junction	6,000
Total	£85,654

In his report for the year ended March 31st last, Mr. Wike refers to the completion during that period of the extension of the sewage works, at a cost well within the estimate of £270,369, the actual expenditure being £262,634. The works have already been decribed in these columns. Briefly, they consist of catchpits, continuous flow settling tanks, first contact beds, and storm beds which can also be operated as contact beds, the whole being capable of dealing with approximately 65,000,000 gallons per day.

In view of the recent opinion expressed by the Local Government Board and the West Riding Rivers Board that some secondary treatment must be added, the corporation submitted a further scheme to these authorities early in the year under report. A Local Government Board inquiry was held in respect of the proposal and the approval of the board has since been obtained, but in view of the present crisis the execution of the work was deferred.

Observations of the working of the main outfall sewers since the duplication was completed have been continued throughout the year, and the general improvement previously reported as to the absence of silting in the sewers and the regular action of the overflows have been maintained.

A RIVER COVERING.

Under the Sheffield Corporation Act, 1914, powers were obtained to cover that portion of the river Sheaf between Exchange-street and the river Don, where the properties are being purchased for street improvements and market purposes. This was one of the first works necessary to be executed before the street improvements could be carried out, and the council decided to proceed with it forthwith. Tenders were invited, and a contract for the work was let early in the year. Owing to the war, the progress has not been so rapid as it would have been, but when the Treasury decided to curtail expenditure, the work was then well advanced, and in view of this, its complicated character, the obstruction caused by plant in the river bed, the danger of flooding, and the possibility of compensation claims arising, it was permitted to proceed. The work consists of diverting the river and contracting it to a uniform width of 36 ft., its original width being from 50 ft. to 70 ft.

BRIDGES.

Both the Sheffield City Council and the West Riding County Council are responsible for High Bridge, Owlerton, which for a long period has been a serious impediment to vehicular and pedestrian traffic. The two authorities have therefore agreed to reconstruct this bridge and to carry out certain street improvements and approach works, at an estimated total cost of about £7,000. The bridge is on the main road to Penistone, and crosses the river Don, which at this point forms the boundary line between the city of Sheffield and the Wortley rural district. On each side of the bridge the roadway is 50 ft. wide, but the bridge is only 22 ft. wide, with steep approaches.

The new bridge will be 50 ft. wide, the same width as the road, and built of brick and concrete faced with stone. The level of the roadway over the centre of the bridge will be lowered 3 ft. 6 in., altering the gradient of the approaches from 1 in 30 to about 1 in 70. Accommodation will be provided on both footways of the new bridge for gas, water, post office, and other services.

Contract drawings and particulars had been prepared and operations commenced when the Treasury began to curtail capital expenditure, but in view of the forward state of the work and the necessity for the scheme being completed the contract was allowed to proceed.

Leppings Bridge, Hillsborough, is a very similar case to the bridge at Owlerton. It crosses the river Don, separating the city from Wortley, and at times the traffic on it is very congested and several accidents have occurred. Its present width is 22 ft., while the roadway approaching it on each side is at least 45 ft. wide; also there is a sharp bend in the road at one end of the bridge.

The Sheffield City and the West Riding County Councils have conferred and agreed on a scheme for widening the bridge to a minimum of 45 ft. and improving the approaches, at an approximate total cost of £6,900. The drawings and specification have been prepared, but the actual execution of the work has been deferred on account of the war.

A survey of Staniforth-road Bridge, which crosses over the Sheffield and South Yorkshire Canal, has been made and a scheme prepared for the construction of a new bridge 50 ft. wide, as against the present width of 32 ft.

LOADING DOCK AND SIDING.

A loading dock and railway sidings at the Great Central Railway Company's goods yard, Stevenson-road, in connection with the disposal of dry refuse to the corporation's tip at Renishaw, were completed during the year. The dock is 75 ft. long by 35 ft. wide, capable of accommodating four railway wagons, and built of masonry walls with an awning over of galvanised corrugated iron sheeting, supported on steel framing. In addition a weighbridge, office, and sanitary accommodation are provided, and approach road, entrance gates, fencing, gas and water services, and the necessary railway sidings and connection.

The site was secured by arrangement with the railway company, and the whole work was executed within the loan of £2,000 sanctioned by the Local Government Board.

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—The rapid increase of sand wastes around our coasts is indeed a serious one, and Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian*

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

An Eastern Sub-District meeting (Suffolk, Norfolk and Cambridge) will be held at Bury St. Edmunds to-morrow (Saturday).

PROGRAMME.

2 p.m.—Meet at Shire Hall, where the members will be received by Mr. W. Lionel Jenkins, ASSOC.M.INST.C.E., A.M.I.MECH.E., A.I.E.E., P.A.S.I., &c., county surveyor, West Suffolk County Council.

Read minutes of previous meeting.

2.30 p.m.—Mr. William H. Eley, ASSOC.M.INST.C.E., engineer and surveyor, Newmarket Urban District Council, will read a paper on "War-time Economy by Local Authorities;" discussion.

4.30 p.m.—Afternoon tea at "Forrest Dean," by kind invitation of Mr. W. Lionel Jenkins.

J. R. MEAD, *Hon. Sub-District Secretary.* H. T. WAKELAM, M.INST.C.E., *District Chairman.*

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

The fourteenth annual general meeting of this association will be held in the Caledonian Salon, Holborn Restaurant, London, on Thursday next, at 3 p.m.

Papers: "The Work Done at Salford by the Activated Sludge Process," by W. H. Duckworth, F.C.S., and "Recent Improvements in the Construction of Cultivative Tanks," by W. D. Scott-Moncrieff, M.I.MECH.E., F.R.S.I., past-president.

Discussion.

J. B CROLL, *Hon. Secretary.*

INSTITUTION OF WATER ENGINEERS.

The twentieth annual winter meeting will be held at the Geological Society's apartments, Burlington House, W., on Friday, December 10th, commencing at 2.30 p.m. A discussion will be invited on "The Necessity for Defining the Term 'Domestic Purposes' in General and Private Water Acts."

The election of the president and council for the year 1916-17, also the election of the auditors for the year 1916 will take place at this meeting.

PERCY GRIFFITH, *Secretary.*

Mid-Renfrew Town Planning Scheme.—The Upper Renfrewshire District Committee of the Renfrew County Council have given notice of their intention to apply for authority to prepare a town planning scheme to be designated the "Mid-Renfrew Town Planning Scheme," for the parishes of Eastwood, Paisley, Renfrew, and Neilston.

Leaky Swimming Baths.—In most towns swimming baths are closed for the winter months. This gives an opportunity to repair any leaky places. The bottom of the swimming bath at Fettes College, Edinburgh, which leaked very badly, has been recemented and lined with glazed bricks. We have received a report that for making the cement waterproof the powder Pudlo was employed with excellent results.

A Glossary of Road Terms (By H. Percy Boulnois, M.INST.C.E., St. Bride's Press, Limited, 24 Bride-lane, E.C., price 2s. nett).—The movement towards standardising the principal roads throughout the United Kingdom has rendered it necessary to correlate the nomenclature of road terms in use in different districts, and Mr. Boulnois has compiled a glossary with the hope that it may form a basis for such a correlation.—*Times Engineering Supplement.*

Surveyors' Institution.—A paper entitled "English Timber During and After the War" will be read on Monday, December 13th, at a meeting of the Surveyors' Institution to be held at Great George-street, Westminster. The chair will be taken at 4 o'clock instead of 8 p.m. At 3 p.m. the Earl of Selborne will open an exhibition in the institution buildings, organised by the English Forestry Association, illustrative of Mr. Duchesne's paper.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

BOROUGH SURVEYOR AND ENGINEER.—December 11th.—Corporation of Hertford. £350 per annum.—Town Clerk, The Castle, Hertford.

BOROUGH SURVEYOR.—December 13th.—Stratford-upon-Avon Corporation. £275 per annum.—Mr. R. Lunn, town clerk.

TEMPORARY ENGINEER AND SURVEYOR.—December 14th.—Portland Urban District Council.—Mr. R. A. Colenutt, clerk, Council Offices, New-road, Portland.

SURVEYOR'S CLERK.—Wilton Rural District Council.—Mr. R. A. Skelton, district surveyor, Bemerton, Salisbury.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

NOTTINGHAM.—December 6th.—For the execution of repairs to school buildings, for the Education Committee.—Mr. A. Dale, city architect, Guildhall.

SLIGO.—December 14th.—For the erection of a pavilion, construction of water supply and sewage works, and other works, for the county council.—Mr. M. Keane, secretary, Court-house, Sligo.

BRADFORD.—December 15th.—For the execution of repairs to buildings, for the Commissioners of Works and Public Buildings.—The Secretary, Storey's-gate, London, S.W.

Engineering: Iron and Steel.

MILTON REGIS.—December 6th.—For re-setting two beds of six retorts with regenerative setting, for the urban district council.—Mr. H. W. Kaye, The Gasworks, Milton Regis, Kent.

WOODFORD.—December 7th.—For supplying and fixing steel vertical cross-tube boiler, for the urban district council.—Mr. W. Farrington, surveyor, Council Offices, Woodford Green, E.

SOUTHEND.—December 9th.—For the supply of 100 tons of second-hand straight tramway rails, and 20 tons of curved rails, for the corporation.—Mr. E. J. Elford, borough engineer and surveyor.

LEICESTER.—December 11th.—For the supply of cast-iron pipes and connections, for the Gas Committee.—Mr. H. Pooley, engineer and manager, Gas Offices, Milton-lane, Leicester.

TEWKESBURY.—December 13th.—For the supply of a 6-in. iron ventilating shaft, for the corporation.—Mr. W. Ridler, borough surveyor.

BASFORD.—December 14th.—For alterations to bottoms of existing tanks, constructing an additional detritus tank, and sundry other works, for the rural district council.—Messrs. Elliott & Brown, engineers, Burton-buildings, Parliament-street, Nottingham.

ATHENS.—December 17th—30th.—For the maintenance and working of the undertakings necessary for the water supply, and laying a distributing system.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

WARRINGTON.—December 18th.—For mechanical tipping apparatus for coal wagons, for the corporation.—Mr. W. S. Haddock, general manager, Gas Offices, Warrington.

JOHANNESBURG.—December 30th.—For the supply and erection of ice-making and refrigerating plant, for the municipal council.—Intelligence Branch of the Board of Trade, 73 Basinghall-street London, E.C.

Roads.

DERBYSHIRE.—December 9th.—For the supply of broken stone and tar-macadam, such as granite, basalt, slag, limestone, or other suitable materials, for the county council.—Mr. J. W. Horton, county surveyor, County Offices, St. Mary's-gate, Derby.

CAMBRIDGE.—December 11th.—For the supply of broken granite, syenite, and basalt, or similar stone, for the corporation.—Borough Surveyor, Guildhall.

HORSHAM.—December 13th.—For the supply of tar, for the rural district council.—Mr. W. Dengate, surveyor.

WANDSWORTH.—December 13th.—Tenders are invited for the purchase of a 10-ton Aveling & Porter steam road roller.—Mr. P. Dodd, borough engineer and surveyor, 215 Balham High-road, London, S.W.

HORSHAM.—December 13th.—For the supply of 25,000 gallons of tar, for the rural district council.—Mr. W. Dengate, surveyor, 58 Park-street, Horsham.

REIGATE.—December 14th.—For the supply of from 1,000 to 2,000 tons of granite macadam, for the corporation.—Mr. Fred T. Clayton, borough surveyor, Municipal Buildings, Reigate.

WILTS.—December 15th.—For the supply of granites, basalts, limestones, chippings, tools, implements, Tarvia spraying, and steam rolling, for the county council.—Mr. J. George Powell, county surveyor, Trowbridge.

BERKS.—December 16th.—For the supply of broken road materials, gravel and sand, for the county council.—Mr. A. Langston, Yockney, acting county surveyor, Shire Hall, Reading.

DORSET.—January 7th.—For the supply of broken granite, basalt, quartzite, limestone, and tar-macadam, for the county council.—Mr. E. H. Habgood, acting county surveyor, County Offices, Dorchester.

Sanitary.

GILDERSOME.—December 6th.—For emptying and cleansing ashpits, for the urban district council.—The Surveyor, Council Offices.

HASTINGS.—December 6th.—For laying stoneware pipe sewer and other work, for the corporation.—Mr. P. H. Palmer, borough engineer, Town Hall, Hastings.

CHEPPING WYCOMBE.—December 6th.—For the supply of stoneware pipes, for the corporation.—Mr. T. J. Rushbrooke, borough surveyor.

ETON.—December 6th.—For the supply of disinfectants, for the rural district council.—Mr. H. Thomson, assistant clerk, Stacey House, Slough.

Stores.

HULL.—December 8th.—For the supply of iron, steel, castings, cement, lime, salt-glazed pipes, tars, pitch, bituminous dust compound, and brushes, for the corporation.—Mr. F. W. Bricknell, city engineer, Guildhall.

WANDSWORTH.—December 16th.—For the supply of artificial stone, blue bricks, castings, cement, coal and coke, disinfectants, broken granite, granite kerb and setts, gravel and flints, house refuse collection, removal and disposal, iron bars, lime, bricks, oilman's goods, painters' materials, salt-glazed-ware pipes, scavengers' brooms, slag blocks, hire of steam rollers, sweepers' clothing, Thames ballast and sand, timber, tools, and wood-paving blocks, for the borough council.—Mr. D. A. Nicholl, town clerk, Council House, Wandsworth, S.W.

OTLEY.—December 31st.—For the supply of setts, kerbs, flags, granite macadam, pitch, tar, slag dust, tar-macadam, limestone macadam, and brushes, for the urban district council.—Mr. C. F. Hodgson, surveyor.

The Civic Engineer's Who's Who, compiled by the editor of The Surveyor and Municipal and County Engineer, for a second annual issue is remarkably complete. The biographical matter is full and methodically arranged. The book is published by the St. Bride's Press, Limited.—*Liverpool Courier.*

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

* Accepted. † Recommended for acceptance
‡ Provisionally accepted.

LEWISHAM.—For making up Manwood-road, Crofton Park, for the borough council. Mr. E. van Putten, borough surveyor:—

Road Work.—H. Woodham & Sons, Catford, £1,859.
Footpath Paving.—Atlas Stone Company, Cambridge. 3s. 9d. per super. yard.

LITTLEBOROUGH.—Accepted for supplying and laying electric cables and other works, for the urban district council.—Mr. G. H. Wild, clerk:—

Cables.—W. T. Henley's Telegraph Works Company, Limited, London-wall, E.C.
Switchgear and Transformers.—British Electric Transformer Company, Limited, Hayes, Middlesex.

ST. HELENS.—For the erection of an engine-house and other works, for the Electricity Committee.—Mr. E. M. Hollingsworth, borough electrical engineer:—

Bywater & Sons, Pemberton	£1,935
Ablett & Son, Wigan	1,852
Elliott & Forbes, St. Helens	1,679
J. Pilkington, Rainford	1,663
F. Warburton, Stockton Heath	1,650
C. J. Middlehurst, St. Helens	1,641
J. Yearsley, St. Helens	1,560

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

DECEMBER.

4.—Institution of Municipal and County Engineers: Eastern Sub-District Meeting at Bury St. Edmunds.
6.—Society of Engineers: Mr. A. Steiger, M.Inst.C.E., on "The Modern Development of Water Power." Caxton Hall, Westminster. 7.30 p.m.
9.—Association of Managers of Sewage Disposal Works: Annual Meeting, Holborn Restaurant. 3 p.m.
10.—Institution of Water Engineers: Annual Winter Meeting, Burlington House, W. 2.30 p.m.
13.—Surveyors' Institution: Mr. M. C. Duchesne, hon. secretary of English Forestry Association, on "Timber During and After the War." 4 p.m.

BLAST FURNACE SLAG
From 14 cwt. to 24 cwt. per cubic yard
FOR HIGHWAYS AND BALLAST
Construction of Roads, Repairs, Pitching, Wall Building, Grotto Work, Railway Ballast.
JOHN FREAKLEY & CO., Ltd., Coneygre Slag Works, DUDLEY PORT, TIPTON.
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35,000,000 SQUARE YARDS
now in use without a single instance of failure.
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A British Company. Established 1905

APPOINTMENTS OPEN.

BOROUGH OF HERTFORD.

The Corporation of Hertford invite applications for the appointment of a Surveyor and Engineer for the Borough. He will be required to reside within the Borough, to devote the whole of his time to the duties of the office, and not to engage in private practice. Salary £300 per annum and disbursements, with furnished offices, fire and light, free from rates and taxes. One Clerk provided by the Corporation. The successful candidate will be required to take up his duties within 5 weeks from notification of appointment, to enter into an agreement to perform the same, and to give one month's notice to terminate his appointment. The population of the Borough in 1911 was 10,383, and the area is 1,134 acres. The Corporation are the owners of Waterworks, Covered Market and Corn Exchange, Public Library, and other buildings, allotments, &c., and treat the sewage at the town chemically. Applications, in candidate's own handwriting, must state age, marital condition, qualifications, present occupation and past experience (especially in road making and keeping accounts), and accompanied by not more than three testimonials of recent date, must reach the Town Clerk at The Castle, Hertford, on or before the 11th December, 1915, from whom a printed statement of the duties and terms of appointment may be obtained, or the same will be sent by post on receipt of a foolscap envelope, stamped and addressed. Notice will be given to every candidate required to attend before the Council, third-class railway fare being allowed. Canvassing is prohibited and will disqualify. The Corporation do not bind themselves to appoint any applicant.

(Signed) ALFRED BAKER,
Town Clerk.

Town Clerk's Office,
The Castle,
Hertford.
November 19, 1915. (2,771)

PUDLO

MAKES CEMENT WATERPROOF.

Used by many Railway Companies and Corporations, and by the British Government in many Departments.

Failure to waterproof impossible.
Inexpensive and simple in use.

Easy to mix—a powder with powder.

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ROAD MAKING

REINFORCE CONCRETE ROADS WITH EXPANDED METAL

PORT TALBOT: Roadway over Colliery Workings, Margam Park. Mr. William Jardine, Engineer.

THE EXPANDED METAL COMPANY, LTD.

(Patentees and Manufacturers of Expanded Metal.)

Head Office: YORK MANSION, YORK STREET, WESTMINSTER, LONDON, S.W.

Works: STRANTON WORKS, WEST HARTLEPOOL.

URBAN DISTRICT COUNCIL OF PORTLAND.

TEMPORARY APPOINTMENT OF ENGINEER AND SURVEYOR.

The above Council invite applications for the post of Engineer and Surveyor during the temporary absence of their present Engineer on War Service.

The person appointed will be required to act and to carry out all the duties appertaining to the office of a Surveyor to a District Council, and also Engineer to their Waterworks Undertaking, and to devote the whole of his time to the service of the Council. He will be also required to attend meetings of the various Committees and Council which are held in the evenings.

One month's notice to terminate the engagement to be given on either side.

Applicants must have had experience of a Municipal Waterworks Undertaking, and in his application must state age, qualifications, previous experience, and salary required.

No applicant eligible for the Services need apply.

Applications, accompanied by not more than three recent testimonials, must reach my Office on or before the 14th day of December next, endorsed "Engineer and Surveyor."

Canvassing Members, either directly or indirectly, will disqualify a candidate.

R. A. COLENUTT,
Clerk to the Council.

Council Offices,
New-road,
Portland.
November 30, 1915. (2,779)

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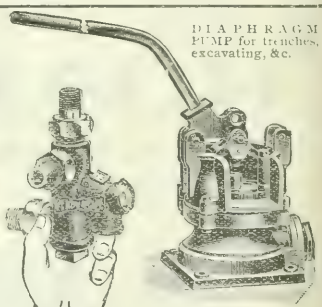

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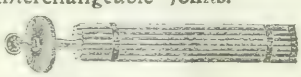

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The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. DECEMBER 10, 1915. No. 1,247.

Minutes of Proceedings.

Sewage Disposal by Dilution.

Although this method of disposal has been thoroughly investigated by the Royal Commission on Sewage Disposal and described in great detail in its reports, we think we are justified in stating that in no place have the principles of the processes through which the sewage passes under this method of treatment been so concisely stated and so clearly described as in the paper which was read by Dr. W. E. Adeney at the meeting of the Institute of Sanitary Engineers last week. Those of our readers who are interested in this subject will find this paper, which is printed on another page, worthy of careful study. The first point which is brought out by Dr. Adeney is that the quantity of dissolved oxygen available in the diluting water must be ample for the purpose of fully oxidising the organic impurities in the sewage effluent, while still leaving sufficient to support fish life. It is quite evident that, while these conditions may exist in some cases in this country, they are so few that this method of disposal is unlikely to come into general use. At the same time there are undoubtedly places where sewage effluents discharged into large bodies of river water are purified to an unnecessarily high degree, and the outlay of considerable amounts of public money might have been avoided if this method of disposal had been more thoroughly understood a few years ago.

The second point which stands out prominently in the paper is the importance of removing from the sewage the greatest possible amount of its organic matters in suspension. In dealing with this subject on previous occasions we have emphasised this factor, as so many cases have occurred where trouble has arisen from the discharge of crude sewage, and it has been found that this was due almost entirely to the deoxygenating effect of deposits of sewage solids on the bed of the river or harbour into which the sewage was discharged. Dr. Adeney apparently assumes that a considerable amount of solids may be present in the sewage effluent if they are carried away with the flow of the stream and not allowed to accumulate permanently in any particular spot. The difficulties of arranging the point of discharge into a river so that these conditions shall be fulfilled at all times are so great, and the possibility of ensuring that the amount of solids in suspension in the effluent shall at all times be uniform, so remote, that we believe it will be found necessary to make provision for securing the maximum removal of solids in suspension in all cases. When once deposits of sewage solids are formed at the bottom of a river or harbour, it is often impossible to remove them except at great expense, and a long time must elapse before their effects upon the diluting water will disappear. The third point in Dr. Adeney's paper, which appears to us to be of great importance, is the statement that when sewage in a putrescent state is discharged into a river, the anaërobic products it contains possess a great affinity for the dissolved oxygen, which is thus rapidly exhausted, whereas if the sewage were in a fresh condition it would be carried for some time in the river without causing any appreciable reduction in the dissolved oxygen content. It is thus obvious that in designing tanks for the removal of the solids in suspension care must be taken to prevent anaërobic conditions arising, and this will necessitate new developments in the construction of such tanks. Fortunately, the tendency during recent years has been to depart from the earlier formula for septic tanks and to reduce the capacity of settling tanks in some cases to twelve hours' flow or even less. In fact, in some quarters it is being recognised that, when special attention is given to the design of such tanks, especially in connection with the inlets and outlets and the depth, the required removal of solids in suspension can often be effected by a retention period of two to four hours, so that if the sewage arrives at the outfall in a fresh condition the process of sedimentation will not set up anaërobic conditions. In places where the sewage is already in a putrescent condition before it reaches the tanks, it is clear that a fresh effluent cannot be produced, and in such cases the required amount of dissolved oxygen in the diluting water will be much greater than if the sewage were in a fresh condition.

It is evident from the foregoing that the several factors we have discussed must be taken into account when considering the adoption of this method of disposal, and that engineers will not be in a position to recommend lightheartedly the application of this system. So far as this country is concerned, the number of rivers with a large minimum flow of highly oxygenated water is so small, and the number of cases in which the only available outlets for sewage effluents consist of small rivers or streams is so large, that in the majority of schemes it will still be necessary to provide filters and all other possible means of

securing highly purified effluents. While, therefore, it is very desirable that disposal by dilution should be thoroughly discussed, and that all the information available with regard to it should be disseminated for the benefit of engineers who may be in a position to utilise this system, it is very important that local authorities and others who may have to provide sewage disposal works should not become possessed of the idea that filters are unnecessary, and that disposal by dilution alone is sufficient in all cases.

* * *

The Institute of Arbitrators.

In our last issue we were able to announce the formation of this body, the latest addition to the number of professional societies formed in the interests of a constituency of specialists. This institute was founded in March last at the instance of members of those professions whose services are usually invoked for the purpose of acting as arbitrators in commercial matters, in references under partnership agreements, building and other trade contracts, with a view to their corporate association, both for their own benefit and in the interest of the general public. For many years past there has been an increasing tendency to submit disputes of the kinds named to arbitration, and to remove them from the domain of the law courts, and this in spite of the fact that the economy for which the parties were entitled to look has by no means been realised in every case. With a greater degree of efficiency on the part of those who undertake the duties of arbitrator, this method of settling disputes will doubtless become even more popular. However eminent the arbitrator may be in the work of his own profession, it is evident other qualities are also required for the proper discharge of his difficult task. To begin with he must possess a thorough knowledge of the law as it affects his own powers and duties in the office which he has undertaken. Again, although, of course, he need not be a lawyer, he must at least have a good acquaintance with the laws of evidence, the rules for the construction of contracts and written documents, while it is essential that he should possess the judicial instinct in a thorough degree. To put the matter shortly, he must be so qualified as to prevent, if possible, the arbitration being merely a basis upon which may be subsequently founded long and difficult legal proceedings. One of the main objects of the institute, therefore, is to secure for its members an opportunity for the acquisition of every kind of knowledge which an arbitrator ought to possess. The institute, of which Lord Headley is the president, has made a most promising start, and under the guidance of a thoroughly representative council it may confidently be expected to accomplish really useful and necessary work towards the achievement of the objects it has in view.

* * *

Maisonettes.

Whatever may be the reason, there can be no doubt that there is at the present time a growing tendency towards the disuse of the large town residences that were so popular a generation ago. It may be that the cause is to be found partly in difficulties connected with domestic service, in the reduction of middle-class incomes, or in the influence of the motor car; but with this the property owner has little concern. He is faced with the result and with the problem of how to render his empty property remunerative under the new conditions—a problem that is being successfully solved in many cases by conversion into maisonettes. The architectural and business aspects of this conversion were considered in a very interesting paper which was read before the Society of Architects last night by Mr. Herbert Freyberg, F.S.I. The leaseholder who desires to turn his property into maisonettes is usually faced with the preliminary difficulty of getting relief from covenants which prevent him from interfering in any way with the structure. In some instances the necessary licence can only be obtained on payment of an increased ground rent, thus placing an initial and unjust financial burden on the proposed scheme. Handicaps may also be imposed in consequence of building by-laws not intended to apply to such cases when they were drafted, and by a disposition on the part of some rating authorities unduly to increase the assessments of converted properties. Even if these difficulties can be successfully surmounted, the architectural problem that has to be faced is not a simple one.

Mr. Freyberg recommends a drastic treatment of the structure by which it may be thoroughly adapted to its new use, and the detailed estimate which he gives certainly shows a good return on what at first sight appears to be a very large outlay. Dealing with the structural difficulties, he points out that the most important is probably that of the stairs. Then there is the question of sanitation, which must be so designed that, while on the one hand the provisions of the Public Health Acts and by-laws are not infringed, on the other hand convenience of arrangement is studied, and the whole system is so designed as to obtain a maximum of economy. In dealing with the problem of the basement it is suggested that the best plan is to ignore it altogether for letting purposes, and to retain it for a resident caretaker with provision for central heating and continuous hot water. The maisonette is undoubtedly increasing in popularity, and for the man of moderate means has certain advantages which neither the house nor the flat can offer. For example, the resident can live in a good neighbourhood at a rent which is comparatively low, and at the same time inclusive, while his liability for repairs is strictly limited and easily calculated. Mr. Freyberg's paper is of great practical value at the present time, and will be read with interest and profit by all architects who are concerned with the problem with which it deals.

* * *

Leeds Sewage Disposal.

From the Leeds Corporation annual report for the year ended March 31, 1915, it appears that the result of the work of sewage disposal has been to reduce the cost very slightly compared with the cost of the previous year when calculated per 1,000,000 gallons, but that the total cost was slightly in excess of the previous year owing to the fact that the volume was higher. Up to the present the chief aim has been to remove the maximum amount of suspended matter in the sewage in order to prevent it being discharged into the river Aire. The average amount of suspended solids removed from the crude sewage amounted to 89·1 per cent, which must be recognised as a favourable result. On the other hand, it is admitted that any further purification can only be effected by filtration, and the necessary works for this purpose were authorised by the Sewage Works Extensions of the Leeds Act of 1908. Unfortunately, the outbreak of war has seriously interfered with the normal progress of constructing these works. Although it was found impracticable entirely to suspend all operations, only those works which were most urgently required were proceeded with during the latter part of the period under review, with the result that the total capital expenditure of these works during the year amounted to £72,389, as compared with the estimated expenditure of £135,000.

In connection with the trade effluents, it is interesting to note that recent investigations show that the total number of manufacturers' premises connected to the sewers in Leeds is 159, and that the estimated volume of trade effluent discharged

into the sewers per twenty-four hours is 3,786,492 gallons, which represents 24 per cent of the total average daily flow of sewage. Further, there are now in operation 114 settling tanks for preliminary treatment upon manufacturers' premises, and practically all of this number are now under the control of the corporation, in so far as the regulation of flow is concerned, by means of manholes fitted with locked inspection-chamber covers, the keys of which are kept in charge of the sewerage department. Incidentally it may be mentioned that fourteen of the office staff of the engineer's department, and ten of the sewage works staff, joined his Majesty's Forces since the outbreak of the war. This constitutes a good record.

* * *

The Benefits of Town Planning. At the recent annual general meeting of the Institution of Municipal Engineers Mr. W. Louis Carr, the surveyor to the Ruislip-Northwood Urban District Council, submitted a most interesting paper, in which he described some of the principal benefits that have been derived by the Council from the adoption of a town planning scheme. The period of twelve months, during which claims for compensation and betterment had to be lodged, having expired, he was able to deal specifically with these matters. It appears that only four claims for compensation were received, and two of these have practically been withdrawn. Thirteen claims were made for betterment, and it is expected that the receipts from this source will exceed considerably the amount originally anticipated. In regard to the line of streets, a very important decision of the Local Government Board was referred to. In the original scheme two alternative routes were shown for a proposed new road, but the Board held that this could not be done, and that a definite line must be fixed. The scheme provides for a relaxation of the by-laws in the case of new short streets, and in regard to width and construction where land for open spaces is set apart, or wide streets are provided, or where streets are formed around quadrangles. In all of these cases the experience already gained shows that both the council and the owners are satisfied that they are not only unlikely to be a burden on the ratepayers, but that they are more economical to construct, sewer, light, and scavenge. Another matter of importance is the comparatively large number of highways that are to be diverted and stopped up under the scheme. The interests of the public are guarded, inasmuch as the old highways are to remain until certain new [illegible] have been constructed to the satisfaction of the council and opened up for public traffic. At the same time the complicated and expensive procedure of obtaining an order of Quarter Sessions in each case is avoided. Mr. Louis Carr's paper as a whole was of great interest, inasmuch as it dealt with a scheme which is in a comparatively advanced stage.

* * *

Stoke Officials and their Motor Cycles. The perennial squabble over the cost of conveyances for surveyors and their assistants has broken out at Stoke-on-Trent, where the Highways and Plans Committee submitted a proposal that an allowance of £50 per annum should be made to each district surveyor for travelling expenses, in consideration of which he was to provide and maintain in an efficient manner a motor cycle with a sidecar, to be used in connection with his work. The chairman of the committee, in evident anticipation of a keen opposition, explained the recommendation at some length, and we gather from his statement that a great deal of extra work had been placed upon the two district surveyors concerned by enlistments from the staff, and that from this cause and the doing away with horses and traps a saving of £350 a year would be effected, as against the £100 per annum which was involved in the committee's proposition. The opposition, while numerically strong, was as usual woefully weak and somewhat petty, not to say mean in argument. Were the motor cycles to be used for their own enjoyment by the officials? was asked by one councillor, who had his eye suspiciously upon the sidecars. It was explained that the sidecars were suggested by the borough surveyor purely on the ground of safety. Another member looked upon the proposal with all the awe of a "dangerous precedent," and the same gentleman threw out the amiable hint that "if those gentlemen desired to be economical those motor cycles might not be used as they ought to be." It was, it may be allowed, somewhat more generous for the same speaker to propose that when the surveyors were going short distances "they could jump on a car and get there much quicker," though he did not explain why if cycle cars were useful and desirable for long distances they should be ruled out for short distances. After all the main question, apart from inconsequent side issues, was how the officials were to cover 200 miles of streets to the best advantage, and this happily was answered in favour of the cycle cars by the vote of thirty-seven against twenty-eight members of the town council.

* * *

War-time Economy. An excellent sign of the spirit in which municipal engineers are facing the new conditions which the war necessarily imposes on the work of their departments is to be found in the number of papers dealing with possible economies which have recently been submitted to professional societies. The latest to come under our notice was read last Saturday by Mr. Eley, the engineer and surveyor to the Newmarket Urban District Council, at an Eastern Sub-District meeting of the Institution of Municipal and County Engineers. It was inevitable that many of the points with which he dealt should have been partly anticipated in earlier papers, but in some cases his suggestions were quite new. Take the case of public parks and pleasure grounds as an example. He pointed out that a double economy may be effected in regard to flowering plants and shrubs, inasmuch as a substantial reduction in their number would probably also mean the possibility of doing with fewer attendants. Moreover, grass can be prepared and allowed to grow for hay, the council using what they require and selling the remainder. Another useful heading with which Mr. Eley dealt was "In the office." We are convinced that if every member and official, from the highest to the lowest, were thoroughly imbued with the spirit of real economy, great savings of public money could be effected apart from the curtailment of any definite service.

Local Sanitary Labour. In the House of Commons on the 2nd inst. the President of the Local Government Board was asked whether his attention had been drawn to the serious position in which cleansing departments of local authorities were being placed by the depletion of labour for the collection and disposal of household refuse, including the contents of privies and middens; and whether he would take steps to ensure that an essential minimum number were retained, so as to prevent the outbreak of epidemics arising from insanitary conditions. The Parliamentary Secretary to the Local Government Board (Mr. Hayes Fisher), who replied, said it was obvious that a certain staff was necessary for the performance of essential sanitary work. If men engaged on this work, who could not be replaced, were attested under the new recruiting scheme a claim should be made before the local tribunal for their relegation to later groups. This procedure was not, however, applicable to the case of men who resigned their places under the local authority to enlist or take up other work.

C

Recent Improvements in the Construction of Cultivation Tanks.*

By W. D. SCOTT MONCRIEFF, M.I.M.E., F.R.S.I., Past-President.

A description of the "Cultivation" tank appeared in the *Pall Mall Gazette* of September 24, 1892, and this, I believe, was the first that the general public ever read about the bacterial purification of sewage.

It would fill volumes, shelves of volumes, to tell the whole story of what has occurred during the many years that have since passed in connection with the subject of sewage disposal, but I have never had reason to go back upon the principles I advocated from the very first as the essentials to success. These were clearly stated in the paper I read at the Sanitary Congress in Birmingham in 1898.

The chief element of importance then inculcated was that the bacterial processes should be zonal in their action, and that the progressive changes which occur in the conversion of organic substances into these inorganic or mineralised equivalents should be made with the greatest possible uniformity. The reason for this conclusion was to be found in an observation of what occurs in the operations of Nature, where the process is continually at work, and where putrefactive fermentation is the usual preliminary to final oxidation.

It is obvious that in these beneficent operations there must be progressive changes in the chemistry of the food supply, and that, as the work of purification goes on, there must be corresponding changes in the kinds of organisms that contribute, in different stages, to the final result.

What confirmed me in the importance of maintaining successive zonal survivals, in keeping with zonal changes, was the fact that the Ashtead experiments established these favourable conditions and gave results incomparably higher than those derived from processes that ignore them. The figure of 9 parts of nitric nitrogen per 100,000, obtained from ordinary domestic sewage, will always speak for itself. Schemes that have overlooked the importance of these zonal conditions have been the subject of endless discussion and examination; but for the most part they may now be included in the literature of failure.

ZONAL ACTION.

I shall now say a few words about the practical interpretation of the word "zonal." To give effect to zonal action, we must presuppose the existence of colonies of organisms, each established upon suitable media, such as the surfaces of gravel in downward trickling filters, or large flints in "cultivation" tanks having an upward flow. The presence of these organisms in groups, differentiated by the changing character of their environments, represent the survival of the fittest in successive stages, and this was fully proved in my Ashtead experiments. They not only existed in series, but by disarranging the series the whole process was arrested until they had time to readjust themselves. That was in the downward filters. The question arises as to whether there is anything to justify the supposition that zonal action in the preceding putrefactive fermentation is less essential than it is in the oxidising fermentation that should follow it. There is no reason for any such supposition, and any violent disturbance in the life history of the organisms of putrefaction by reverting to aëration at intervals, or by any other kind of irregularity, is just as unfavourable to the work of progressive mineralisation, as has been proved in the case of the downward filters.

It should be explained that the process of downward filtration is more easily arranged than the upward movement of sewage in a cultivation tank. If the sprinkling is regular, with regular intervals of time between each distribution, the rest follows automatically, and the successive colonies of nitrifying organisms are supplied with nutriment that changes in each successive layer of the filtering media. In the upward movement of sewage in a "cultivation" tank it is not so easy to supply similar conditions. If there are any irregularities in the flow, or any part of the tank in which no regular flow occurs at all, the otherwise favourable conditions may be very quickly upset. When this occurs there is no remedy available, and the conditions are apt to become increasingly unfavourable, even to the point of absolute failure. In the original cultivation tank, which you will find illustrated in text-books, the sewage is delivered into a central channel covered with an iron grating at the bottom of the tank, and from this the sewage passes, discharging upwards and laterally, through large flints, into open channels constructed on each side of the tank. In the improved arrangement, which is the subject-matter of the title of this paper, the tank has a level perforated false floor, and the sewage passing under this floor moves upwards to the level of a series of 4-in. land drains laid in lines 2 ft. 6 in. apart, which pass through the further wall of the tank, and discharge into a channel that conveys the effluent to the distributors of the downward filters.

The object of this arrangement is to avoid all irregularities of flow, so that the hydrolytic action should be zonal, just as much as in the case of the downward filters.

RESULTS AT CHERTSEY.

It is unfortunate that the existing difficulties with regard to labour and the delivery of materials have made the progress of the work at Chertsey painfully slow, and I would not have ventured to read this paper if it had not been that one or two results have been obtained that are interesting.

The sewage, at the rate of about 300,000 gallons per day, was passed through four tanks, each 60 ft. by 30 ft. in area and 3 ft. in depth, converted, as just described, into "cultivation" tanks. The quantity of sludge left on the floors of the tanks at the end of a month amounted to 7,500 gallons, or five-sixths of a gallon of sludge on the floors per 1,000 gallons of sewage. By a simple arrangement of flushing the sludge, much diluted, can easily be delivered for disposal on the land. The other point of interest is the molecular instability of the effluent. I did not concern myself with any other element beyond what was necessary to force a conclusion on this point of instability, and it was discovered in an analysis, from which it appeared that the oxygen consumed figure in the effluent fell automatically in eighteen hours from 8·40 to 4·40 parts per 100,000. I consider that the district council was justified in ordering distributors when this unstable condition of the effluent had been ascertained.

And now I must make a few observations which have a very important bearing on what I have already said. Some years ago I read a paper with the somewhat unfortunate title of "The Drainage Problem Solved," and the still more unfortunate printer's addition, for which I was not responsible—"by W. D. Scott Moncrieff." This brings me to the point as to whether the zonal method, which I have endeavoured to describe, is a solution of the sewage problem by bacterial processes, or is not. In the case of absolutely normal sewage—that is to say, the purification of liquids and solids that have passed through the alimentary canal of human beings—I can confidently say that it is not only a solution, but the only solution of the problem on lines that are obviously in keeping with those of Nature. To contradict this statement is to maintain that a truer solution of the problem is to be found in disturbing the conditions favourable to the successive life processes of the organisms which do the work.

I must make a few further observations that are as important as any. The sample of effluent which I now show you has been in this bottle for about seven years and speaks for itself. There can be no doubts about its molecular stability from a sewage manager's standpoint, and it was obtained from a "cultivation" tank, followed by 3 ft. of downward filtration.

A few days ago I had a letter from the county surveyor of Surrey saying that the arrangements continued to work satisfactorily, and I doubt if the "cultivation" tanks have been cleaned out since the first day that sewage was passed into them. The observation I now wish to make is that all this has practically no bearing, or I should rather say no bearing in practice, upon the purification of different

* Paper read yesterday at the fourteenth annual general meeting of the Association of Managers of Sewage Disposal Works.

sewage under different conditions. The [illegible] to the treatment of sewage exactly on the lines of what I have described, and [illegible] Up to the stage when the [illegible] disposal works [illegible] treatment [illegible] anything, or everything, but zonal. Where it has been exposed to the atmosphere in sewers it has been absorbing oxygen with avidity. When it [illegible] it is subjected to virtual anaërobic conditions, in which putrefactive gases are produced under pressure and pass into solution, [illegible] a maximum degree of offensiveness. Afterwards, when it is passed into a [illegible] tank during a twelve hours' flow, it may be allowed to remain there for a period that is [illegible] I may as well speak of it as the zonal organisms. In other words, so far as putrefactive fermentation is involved, the process is violently irregular from start to finish.

All this being so, you can readily understand how hopeless it becomes when further trouble is added by faulty arrangements in the artificial appliances that are apparently designed, in many cases, to make matters worse instead of better. It is true that all the anaërobic changes that occur are in the direction of reduction of the organic complexes, the change to simpler molecular forms; but by aggravating the conditions that are unfavourable to hydrolysis, you arrive at more stable and refractory compounds that either retard further improvement or prevent it altogether. This is what accounts for excessive quantities of organic sludge that ought to have been hydrolised and for septic effluents that resist nitrification. Where it is easy to provide zonal action in sewage disposal works, effect ought to be given to zonal action. There is such a capacity for adjustment and accommodation to changed environments [illegible] their spores, that success may in many instances take the place of failure, and at no great expense if proper uniform conditions are provided, such as I have described.

In conclusion, I wish to say that these principles have received little recognition of any kind; but perhaps those who are more deeply learned than myself in matters of sewage disposal too frequently fall into the habit of persistently missing a quite obvious point. Later on, if all goes well, I hope to have the privilege of reading a further paper on the results obtained from the work when it is completed at Chertsey, and meantime I cannot conclude [illegible] without [illegible] given me [illegible]

Locomotives on Bridges.—Berkshire County Council have adopted the following by-law: "A person in charge of a locomotive within the meaning of the Locomotives on Highways Act, 1896, shall not wilfully cause or suffer the locomotive, or any loaded wagon, truck, or vehicle drawn by such locomotive, to remain stationary upon any highway so that any wheel of the locomotive, wagon, truck, or vehicle rests on a bridge, arch, or culvert mentioned or described in the schedule to this by-law, or within 10 ft. from the abutment of any such bridge, arch, or culvert."

Housing and Town Planning Act Inspections.—At the last meeting of Oulton Broad, Norfolk, Urban District Council the question of the inspections required to be carried out under the Housing and Town Planning Act was discussed, and it was decided that a representation be made to the Local Government Board as to the advisability of postponing further inspections during the period of the war, having regard to the shortage of labour and high cost of materials, and pointing out that these difficulties would tend to increase as men were called up in connection with the recruiting scheme.

Irish Motor Licence Duties and Road Board Grants. The Cork Borough Council in Cork, the *Free Press Journal* states, decided at their meeting the other day to cease collecting the motor licence tax at the close of the year. They had been expecting a grant, and as none will come and the duty of collecting is not mandatory they see no reason for continuing a troublesome and expensive office. The 5 per cent of the amount levied that is paid over to the councils has not been found sufficient to meet the expenses of enforcing payments of the licence duties; and in the absence of loans or grants from the Road Board a reduced collection must be expected, as well probably as serious deterioration of the roads, especially in military areas.

THE MODERN DEVELOPMENT OF WATER POWER.

By Alphonse Steiger, M.Inst.C.E.

On Monday evening, at a meeting of the Society of Engineers, a paper was read by Mr. Alphonse Steiger, M.Inst.C.E., in which it was stated that the modern development of water power, mainly due to the extensive use of electrical energy for a variety of purposes, has brought about a complete change in the construction of turbines and their size, turbines now being in use which give as much as 20,000 b.h.p.

The total capital invested in hydraulic power undertakings is now probably over £500,000,000.

The available power in Great Britain is variously estimated at from 500,000 to 1,000,000 h.p. To develop that power by steam would require 2,410,000 tons of coal per annum, and the value of that coal at 10s. per ton would represent the interest at 5 per cent of a capital of £24,100,000.

Water power is, to a certain extent, dependent on meterological and topographical conditions, and a certain regularity may be obtained by afforestation and by storage, such as is provided for irrigation purposes. Schemes are now being carried out of contemplated to make large swift rivers navigable and to afford large power plants destined to form industrial centres in the future.

Turbines are the most efficient of water motors. They are classified into impulse turbines and pressure turbines, represented by Pelton wheels and Francis turbines respectively, various types of which are described. The selection of a turbine does not depend on the fall alone, and in selecting a turbine the efficiency under varying conditions should be carefully considered, as efficiency represents capital value. The falls so far utilised range from 2 ft. up to 5,000 ft., and a Pelton wheel is described utilising a fall of 2,800 ft.

The governing of turbines has been completely revolutionised owing to the requirements for generating electricity, and has been brought to a high state of perfection. The prompt action of the modern hydraulic governor calls for special devices for the protection of pipe lines against bursting owing to water-hammer, and an ingenious mechanism is shown whereby that danger is prevented without any waste of water.

The paper next deals with the cost of power. Not the capital outlay, but the annual expense of a power-generating plant should be the deciding factor. A comparison of the annual costs of various sources of power is given, showing that these costs are less in the case of a water-power plant, even if the capital expenditure on it has been greater than that of a steam plant of the same power. With a good load-factor a larger capital outlay for a water-power plant is admissible, and such plants with auxiliary steam power to make up for shortness of the water supply in the dry season are remunerative. An instance is mentioned where the power for a heavy day-load is supplemented by pumping water at night-time to a reservoir which is used during day-time.

Water power has become of such importance in recent years that a State monopoly has been considered in some countries. Some protection against injudicious use of water for one purpose to the detriment of others is necessary in order to facilitate the development of water power where it benefits the population of a district.

The purchaser of a turbine should ask for a definite guarantee of efficiency of the turbine he proposes to buy, not of the power, and, where the conditions of water supply vary, of the efficiency under a diminished water supply. The paper states how the claims should be formulated to prevent disputes or lawsuits.

In the concluding pages the method of testing turbines and the various operations necessary for testing turbines were described, and it was shown that a great difference in the results may be obtained by inaccuracy or carelessness in the measurements of water.

Waterproofing of Flat Roofs.—A cement finish to a concrete flat roof is likely to become much more prevalent now that the question of making them absolutely watertight has been solved by waterproofing the cement. In this respect we learn that some roofs have been successfully constructed at Newcastle-on-Tyne during the last three years. The cement waterproofing powder Pudlo was employed, and the architect has expressed his great appreciation of the result.

War-Time Economy by Local Authorities.*

By WILLIAM H. ELEY, A.S.C.E.E., Engineer and Surveyor to the Newmarket Urban District Council.

In offering the following few suggestions under several well-worn headings, the author realises that they are by no means exhaustive, and in many instances are very trifling. His object is to arouse a discussion which will lead to many valuable suggestions by members, and result in true economy.

The motto of every municipal engineer should at all times be "Efficiency with Economy."

HIGHWAYS.

Great attention should be paid to a systematic watching of roads. By the aid of a good patcher or two and a few intelligent workmen, the life of a road can be somewhat extended, and subsequently extensive repairs can be delayed without much expense or danger to the road and its users.

The amount spent on surface tarring should not be curtailed, but rather increased, where the exigencies of the situation render this necessary. It has been said that "a good coat of tar and chips is worth a coat of metal;" the author does not go so far as that, but suggests that surface tarring is real economy, both from a point of view of prolonging the life of the road and of reducing street watering and scavenging.

Where a road is thoroughly worn out and patching is quite out of the question, then the surface should not be allowed to remain in that state. If the road surface is worn out any delay in its proper repair is a menace to its foundation which will inevitably lead to a larger expense. It is also essential, from a military point of view, that roads should be kept up to a good standard in order to assist transport. If a road requires repairing it should be done with suitable material. There is no economy in using a cheaper and less durable material on a road which has hitherto always been repaired by a durable, more expensive material. This is mentioned because it has been stated that some authorities are using local flints where a granite surface has always been considered necessary.

A great deal of money has been spent of late years on the improvement of roads; the present standard should be kept up, even if, for the time being, at any rate, no fresh improvements are entered into.

Road engineers generally admit that a cheap road surface in the first instance is not always cheap in the long run, and what may seem expensive at first will often prove cheaper in the end. In some methods of road making, although the cost be two or three times as much as others, the road often outlives a cheaper road three or four times, thus showing that the road authority in the first place is often wiser and more economical.

In the past much money has been wasted in futile experiments and on account of red tape. As an illustration of this, a certain road surface improvement may be mentioned which was the subject of a loan, one of the conditions of granting the loan being that none of the council's staff should be engaged thereon. The job was let to the contractor who submitted the lowest tender, and the price per super. yard was several pence more than the same surface had from time to time been when constructed by the local authority's own men.

In urban districts the main roads are the subject of a grant from the county council; if the county surveyor did not require quite such a high standard as hitherto, it would be possible in some districts to reduce the amount of the grant during the war and still have fairly good roads. In connection with this, systematic patching would be of great assistance. The amount of the grant is generally fixed according to the estimated life of the road, taking into consideration the traffic it has to bear. Thus, if the life of a road is assumed to be six years, it is usual to recoat one-sixth of its surface every year; now, supposing (1) by not expecting quite so high a standard, and (2) by systematic patching, the life of the road is extended another year, the saving would in this instance be about 2 per cent of the grant, after allowing for the increased patching. Of course, in the case of a road of a shorter life than this, if extended a year, the saving would be more. In the case of a road of a longer life it could probably be extended several years.

Hitherto much money has been expended in having grass edges of roads trimmed; at such a time as this that work could be dropped and only the drainage grips kept dug out.

Scavenging and watering can be reduced as far as public health will permit. On tarred roads just the sprinkling of the side channels is all that is necessary. Of course, it may happen that the cost of scavenging cannot be reduced, and may even be increased, owing to the presence of large bodies of troops.

Scavenging, watering and road damage can in some districts be more economically carried out by mechanical contrivances than with horses and carts, but at the present time it is difficult to find the necessary capital.

In some towns, in the case of a fall of snow, considerable expense is incurred in its removal, and if in the forthcoming winter much snow falls, only the quantity necessary for the prevention of the interference with traffic should be removed.

PUBLIC PARKS AND PLEASURE GROUNDS.

We have read a great deal recently about waste land that could be placed under cultivation, and public parks and pleasure grounds have been cited as examples. In the main the author agrees with many of the proposals, but doubts the power of local authorities to cultivate parks, &c. Nevertheless, this is not a time for spending money on flowering plants, shrubs, &c., and if these are not planted fewer attendants would be needed. In public parks the grass could be carefully prepared and allowed to grow for hay; the council could use what they required and sell the remainder.

Quoit beds, tennis courts, bowling greens and cricket pitches are often maintained in public grounds; much pleasure is derived therefrom, and doubtless they would be much missed, but at the present time they are not a necessity.

Public menageries are sometimes found in our parks, and while not advocating their discontinuance he does consider they should not be added to, but only maintained.

REFUSE COLLECTION AND DISPOSAL.

In most of our towns it is the custom for the whole of this service to be carried out at public expense. Why not adopt the method by which the householder is required to place his dustbin outside on certain days? It is unsightly and has many disadvantages, but it is surprising how much more a horse, cart and two men can do in a day if this method is adopted. Having worked both systems, the author unhesitatingly says that a considerable saving can thus be effected. In fact, the second man with the cart can sometimes be dispensed with and even then more loads collected daily.

Householders should be impressed with the idea that everything possible should be burnt; the result being that the bulk of the refuse to be removed would be lessened, and in most instances it would be less objectionable.

Of course, the calorific value of the refuse would be diminished thereby, and possibly more coal would have to be used to assist steam raising—*i.e.*, where the burning of the refuse is utilised for this purpose.

Scrap iron and certain kinds of tin, if sorted from the refuse, are saleable, and in some districts more than pay for sorting. If trade refuse is removed it should be charged for; some trade refuse is good for fuel, and tradesmen should be encouraged to bring this kind to the destructor, where it can be destroyed free of cost, and thus coal would be saved.

In connection with the matter of steam raising, there are some forms of fire-bars which give results akin to forced draught, and if used in destructor cells the refuse is burned more thoroughly, more steam is raised, and the resulting clinker is harder and more saleable.

The author also believes that there are several good economisers on the market, but has no personal experience of them.

He has made certain experiments with fuel composed chiefly of chalk mixed with coal dust and tar.

* Paper read on Saturday last at the Eastern Sub-District section of the Institution of Municipal and County Engineers at Bury St. Edmunds.

[illegible] is possible with a good draught to use a fuel of this description, and so save [illegible]

PAINTING AND DECORATING PUBLIC BUILDINGS AND WORKS.

Because it has been the custom to paint and decorate at stated intervals, it does not necessarily follow that such work is absolutely needed. Repaint, by all means, if necessary for preservation, and in connection with this one should remember that some colours are cheaper and more durable than others.

SEWERAGE AND SEWAGE DISPOSAL.

No [illegible] expenditure under this head should be allowed to endanger public health might be endangered. In pumping schemes any infiltration of subsoil water into the sewers adds to pumping, and if the infiltration can be reduced at a reasonable cost it is money well spent, which must ultimately result in a saving.

Every available piece of land should be placed under cultivation as far as a good effluent will permit. Suitable crops should be grown and used by the local authority, any surplus being sold.

In the engine-room all engineer's stores should be carefully watched and economy practised; for example, wiper cloths which can be washed and used again are more economical than the cotton waste, which is so often thrown away when only partly used.

CEMETERIES.

In ordinary times a good deal of money has been spent on plants, shrubs, grass trimming, &c., all to beautify our burial grounds. Much of this money could, for the time being, be saved, without any disrespect to the dead. Further, in many of our cemeteries there is considerable space as yet unused, and if that be properly prepared, grass could be grown and made into hay.

PUBLIC MUSEUMS, ART GALLERIES, AND LIBRARIES.

The closing of these buildings would perhaps be a hardship to many, but their hours of opening could be curtailed, and thus a saving effected in lighting, heating and attendance. It might be possible in the larger towns to close some of the branch libraries, and adopt shorter hours in others. In the reading-rooms fewer papers and magazines could be taken, and fewer books purchased for the lending library.

WATERWORKS.

Under this heading there seem to be very few possible ways for studying economy, but the remarks under sewerage and sewage disposal relating to engineers' stores apply again. Rigorous detection and prevention of waste and misuse will reduce the cost of pumping, and some saving might be effected in that respect. The question of the maintenance of water meters by percentage of cost contract with the makers may in some places be cheaper than payment for every individual repair.

DEPOTS AND STORES.

It should be impressed upon all storekeepers that this is a time for care and economy. Waste must be prevented, and all tools thoroughly used up before being discarded.

Disinfectants are sometimes given away to ratepayers by councils, and doubtless, through ignorance, these are not properly used. It would seem a good plan either to somewhat dilute the disinfectant before serving out, or to purchase a cheaper fluid of less germicidal value. In any case, with instruction labels on the bottles, waste in this direction would no doubt be lessened.

The harness-makers' bill will be less if the harness is properly dressed and looked after; and all cart wheels will last longer if the tyres are renewed or cut and shut when they become enlarged, but not worn too thin.

Horses should be sensibly fed, but not like prize bullocks.

PUBLIC LIGHTING.

In towns where street lighting has been prohibited or curtailed, a saving has been forced upon local authorities; there are yet some towns where full lighting is in vogue, and the question of a reasonable reduction is worth considering.

IN THE OFFICE.

Extensive holdings of books and ledgers are not at all necessary, and their use should be discontinued.

Ledgers are generally obtained for one year's accounts only, whereas in some instances it would be possible to purchase a book to contain several years' accounts (without making the volume too bulky); thus cost of bindings would be saved.

It is always economical to use up a book to its fullest extent.

In some districts it would be quite possible and permissible for local letters, such as agendas, registered notices, &c., to be delivered by hand, which would be done more cheaply than through the post.

Considerable saving in printing, postage, labour, firing and lighting could be effected if council and committee meetings were held at less frequent intervals and in the daytime.

If such articles as blotting paper, pens and ink were changed when necessary, and not at stated intervals, some economy might be effected.

Every effort should be made to reduce the lighting and heating account of public buildings and offices.

In the work of duplication of reports, &c., there should be no waste copies.

Drawing office stationery and materials ought to be carefully expended.

On the whole, stationery, printing and office requirements should be purchased with care, and as cheaply as possible, consistent with efficiency.

IN GENERAL.

No plant of any description for which there is a demand should be allowed to remain idle; sell if it is likely to be of no further use, and hire it out if required again.

Any new works should be designed to give efficiency with economy, and one should realise that this is not the time for mosaic floors for engine-rooms; brass plates, moulded brick, stone or terra-cotta dressings for stables and depots.

All work that can be possibly shelved means an increase of our national wealth and helps the ratepayers to bear the burdens of our times more cheerfully.

Mr. Eley added that since writing the paper he had prepared some statistics showing the cost of dust collection at Newmarket. There were two systems in vogue—one, the ordinary one where the house refuse was collected from the premises, and the other where the householders placed the receptacles outside their premises. In the first district the cost per dustbin was 4s. 5·88d per annum; the cost per head per annum was 11·28d., and the cost per load 3s. 11·38d., as compared with the prices in the second district of 1s. 2·8d., 2·35d., and 1s. 8·17d.

A Glossary of Road Terms. By H. Percy Boulnois, M.INST.C.E. St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, E.C. Price 2s.—Mr. Boulnois has achieved far more than he may imagine by this production of his pen. He set out to standardise the nomenclature of road terms; in addition he had made a valuable addition to English literature. To the untutored it is like reading a new language; Mr. Boulnois says it isn't anything like "complete." At any rate, it is a valuable *vade mecum* which no one has attempted before.—*Portsmouth Times.*

Cost of London Local Government.—In the House of Commons on Wednesday the President of the Local Government Board was asked whether his attention had been called to the estimate of the cost of local government in London at 52s. 6d. per head, compared with 31s. 6d. in Birmingham for the same service; that there were in London twenty-nine town clerks, twenty-nine borough surveyors, twenty-nine borough accountants, and a due setting of subordinates in every case; that the cost of collection of street refuse was 42s. a ton in Westminster, as compared with 11s. 8d. in St. Pancras; and whether, in view of the necessity for economies and of utilising to the full the nation's resources, he would have enquiries made into the expenditure of municipal administration in London. Mr. Long, in reply, said that no comparison could properly be made between the expenditure in London and other places. London was a county containing several boroughs, and its size, population, and other circumstances placed it in a unique position. A comparison of expenditure based on the populations of cities like Birmingham, Liverpool, Manchester, and London was misleading. London happened to be the capital of the country, the city in which Parliament met, and an immense expenditure was entailed upon London which was of no benefit to the city alone.

The Disposal of Sewage by Dilution: A Bio-Chemical Method of Purification.*

By W. E. ADENEY, D.SC., F.I.C.

A large volume of evidence has been accumulated of recent years by the Royal Commission on Sewage Disposal, and by a number of individual investigators, both at home and abroad, which has definitely proved that, when normal crude sewage matter is discharged into a non-tidal or tidal stream, under such conditions that the liquid portion is rapidly and largely diluted with "clean" water, and the solids in suspension are carried away with the flow of the stream, and are not allowed to accumulate permanently in any particular spot, both portions of sewage matter are consumed as food materials by various forms of living organisms, and converted into innocuous forms of matter, without causing at any time injury or detriment to the fish life or to the amenities of the stream.

Notwithstanding this evidence, however, much doubt and uncertainty still appears to exist among engineers and chemists as regards the precise conditions which must attend the discharge of sewage matter into a given stream to ensure the satisfactory disposal of the sewage matter, and to avoid undesirable results of any kind in the stream itself.

As the writer has himself devoted a good deal of time to the study of this question, it has occurred to him that he would be meeting the wishes of the members of the Institute of Sanitary Engineers by selecting the subject of the dilution method of sewage purification for the paper, which they have done him the honour of inviting him, through their president, Mr. Cotterell, to communicate to them.

It may be fairly claimed that the chemical and biological principles which underlie the dilution method of purification have now been successfully worked out; and the writer proposes to give in the first place a brief explanation of them. They are fortunately very simple, and the experienced water engineer need have no hesitation in proceeding to tackle them.

Some years ago the writer concluded from the results that he had obtained from an extended experimental investigation that the most important effect that normal sewage matter exercises in a stream is the more or less rapid absorption of the atmospheric oxygen dissolved in the waters of the stream.

This conclusion has since been confirmed by the laborious and prolonged investigations that have been carried out by Dr. Houston, Dr. McGowan, Mr. Colin Frye, and Mr. Kershaw for the Royal Commission on Sewage Disposal; by the extensive series of observations carried out by Dr. Soper, president of the Metropolitan Sewerage Commission of New York, and by his assistants, in New York Harbour; and by the observations of other investigators, both at home and abroad, and notably in this country by Prof. Letts and his pupils in Belfast, and by Dr. Fowler and his pupils in Manchester.

The absorption of the dissolved oxygen is caused by bio-chemical changes which water bacteria, by reason of their quite unusual mode of nutrition, bring about between the dissolved oxygen and certain of the constituents of the sewage matter.

Two classes of bacteria take part in these changes. First, the saprophytic (Greek word *sapros* = rotten) bacteria feed upon the waste organic constituents of the sewage matter; and, secondly, after the organic constituents have been wholly consumed, the nitrifying bacteria feed upon the ammoniacal compounds.

Both these classes of bacteria flourish in the open —in fresh and in sea water; and they are therefore unlike in this particular the disease-producing bacteria, which are always parasitic and cannot live in open water.

The chemical changes which these bacteria effect in polluted waters may be conveniently termed fermentative or bio-chemical changes, to distinguish them from those purely chemical changes which occur between bodies that exhibit direct chemical affinity for one another when they become mixed together.

PRACTICE OF THE DILUTION METHOD.

Saprophytic bacteria can utilise the dissolved and solid suspended organic constituent of sewage matter as food materials, but in the practice of the dilution method, for reasons which will become plain later on, it must be the aim of the engineer to allow as little opportunity as possible for the solid constituents of sewage matter to be attacked by the water bacteria. The physical conditions of the stream must be such as to ensure their consumption by living organisms higher in the scale of life than bacteria if they are to be discharged into it. Otherwise they must not be allowed in the stream.

It is necessary therefore to consider the question of the disposal of the liquid portion of sewage matter separately from that of the disposal of the solid portions, and it will be convenient to deal with it first.

It is possible by suitable experiments to trace the chemical changes that occur in a diluted sewage liquor, simultaneously with the absorption of dissolved oxygen in the diluting water, and it has been found that in all cases where the dissolved oxygen is in excess of the sewage liquor the chemical decomposition of the latter takes place in two quite distinct and progressive stages of chemical change.

During the first stage, as already indicated, the organic constituents are alone affected—about 80 per cent of them are completely oxidised to carbon dioxide, water and ammonia, the remaining 20 per cent being utilised by the bacteria in building up the new materials that they require for their growth and multiplication. But, inasmuch as these building up, or, as the chemist terms them, these synthetic processes, are exercised upon organic materials of complicated composition, it will readily be understood that by-products must also result from them.

These by-products are coloured organic substances, remaining in solution, or rather in a colloidal condition in fresh water, and imparting a greenish yellow to brown tint to the water, according to the quantity of sewage liquor originally mixed with it. They are precisely similar in their physical and chemical properties to the "humus" of cultivated soils.

In the case of sea water, however, these humus bodies do not remain in solution, or suspended in it in a colloidal state, but are precipitated from it more or less rapidly as they are formed.

Thus, by the action of saprophytic bacteria upon the dissolved organic constituents of the sewage liquor, when amply supplied with dissolved oxygen, about 80 per cent are completely oxidised to the mineral forms of matter—carbon dioxide, water and ammonia; and of the remainder, much the greater part—upwards of 15 per cent—are converted into "humus," also a mineralised form of matter; while less than 5 per cent go to form the substances of the new bacteria.

After the bio-chemical destruction of the organic constituents of the sewage liquor has been accomplished, the second stage of change is started, and in the course of time completed by the nitrifying bacteria. These bacteria feed upon the ammoniacal compounds originally present in the sewage matter, and also upon those formed during the first stage of fermentation. The "humus" matters, also formed during the first stage of fermentation, likewise exercise a very important influence on the course of fermentation of the ammoniacal compounds.

Thus, when they are absent from a water or present only in minute quantities in it, as in the case of sea water, relatively large quantities of nitrites, but little or no nitrates, are found among the end products of the fermentation; but when "humus" bodies are present, nitrites do not occur among the end products, only nitrates and carbon dioxide, together with, of course, dead organisms, the first being relatively large in quantity, the second small, and the last very small.

"Humus," as above stated, does not remain in solution, or suspended for any length of time in the colloidal state, in sea water; consequently in polluted tidal waters nitrites are formed to the exclusion of nitrates. This fact no doubt affords the explanation of the interesting observation made by Dr. Soper in the course of his investigations of the waters of New York Harbour. He has found that decided quantities of nitrites exist in these waters. The sewage from Greater New York is discharged prac-

* Paper read at a meeting of the Institute of Sanitary Engineers held at Caxton Hall, Westminster, on the 1st inst.

largely in a crude state into the harbour, wherein the solids are deposited and the sewage liquor remains, largely diluted by the river and tidal waters in the same, for several days, and undergoes almost complete fermentation before being gradually carried out to sea by tidal action.

If the character of the bio-chemical changes which these two classes of water bacteria bring about in diluted sewage liquor, as just described, be carefully considered, it will be found that they are quite unusual when compared with the chemical changes which other organisms, higher in the scale of life, bring about in the course of their vital processes.

The mode of nutrition of these bacteria is, in fact, quite unlike that of any other form of life—vegetable or animal.

It is owing to this unusual mode of nutrition, as well as to their universal distribution, that the impossibility of including them in any scheme of general classification of animal and vegetable life is due.

Their peculiarity in this respect lies in the fact that they obtain the energy they require for carrying on their vital processes from the oxidation of their food materials, and not from the oxidation of any portion of their own substance. They also appear to utilise but a small portion of the energy which they set free in this way for the purpose of their own development and multiplication, unless rise of temperature in their surrounding medium be regarded as a factor involved in their development.

As a result of their peculiar mode of nutrition they convert when amply supplied with dissolved oxygen, the large proportion of upwards of 95 per cent of the fermentable constituents of the sewage liquor in a polluted water into the innocuous mineral forms of matter—carbon dioxide, nitrates and humus, and, unlike most animal forms of life, they leave no product of their own action, nor unchanged portion of the sewage that could in any way subsequently become offensive, or detrimental to the stream.

The dead bacteria which have flourished upon the sewage liquor, in common with all the other end products resulting from the fermentation of the sewage matter, form favourable food materials for green vegetable growths, and for other forms of life.

There is a further result which attends the peculiar mode of nutrition of water bacteria in the presence of an ample supply of dissolved oxygen, to which the attention of engineers may usefully be drawn, although perhaps it is of more interest to the chemist than to the engineer. It is that the quantities of dissolved oxygen absorbed, and of the end products formed, on the completion of each stage of fermentation, are constant for similar volumes of the same polluted water.

BACTERIA AS SCAVENGERS.

Such is the efficient and harmless manner, so far as the fish life and the amenities of a stream are concerned, in which bacteria act as scavengers in sewage-polluted waters, always provided that a relatively ample supply of dissolved oxygen remains in the water at all times.

When, however, the conditions are reversed, and the sewage liquor in a stream is in excess of the dissolved oxygen in its waters, the bacteria flourish on the increased supply of food materials in such great numbers that they absorb the dissolved oxygen more rapidly than it can be replenished by the absorption of fresh oxygen from the air.

The first consequence of this is—the oxygen content of the water falls below the minimum level required by the fish and other normal forms of life supported by the stream for the continuation of their vital processes. The bacteria, however, continue to feed and flourish on the sewage matter, and when the dissolved oxygen has been entirely exhausted they obtain, by the exercise of another marked peculiarity in their mode of nutrition, the oxygen which they require for the continuation of their vital processes—that is, by decomposing inorganic oxygen compounds such as nitrates and sulphates—that may be present in solution in the water. When both nitrates and sulphates are absent, then the required oxygen is obtained by the decomposition of organic oxygen compounds; in other words, anaërobic or putrefactive fermentation is set up by the bacteria in the fermentative organic constituents of the sewage matter.

When nitrates are thus robbed of their oxygen, the residual substances are quite odourless and innocuous, and the polluted water remains in consequence inoffensive to smell, although deoxygenated.

When, however, sulphates or organic substances are robbed of oxygen in this way, the residual substances in both cases emit offensive odour, so that the waters containing them are offensive to the smell and in appearance, as well as deoxygenated.

If sulphates are present in a water, sulphuretted hydrogen is produced, and this body forms with any iron compounds that may be present in the polluted water a black sulphide of iron—hence the black or discoloured appearance of many highly polluted waters.

It may here be noted, in passing, that the sulphuretted hydrogen and the sulphide of iron thus formed and deoxygenated organic compounds possess the property of very rapidly reabsorbing oxygen when the polluted water containing them becomes mixed with "clean" water. It will be necessary to deal with this point more fully when the disposal of sewage solids comes to be considered. It will then be seen that it is one of great practical importance.

The amount of dilution with "clean" water which must be given to a sewage liquor to ensure the condition that the dissolved oxygen in the mixed liquor and "clean" water shall be in excess of the fermentable constituents of the liquor will depend upon the quantity of oxygen dissolved in the diluting water.

It is well to bear in mind in this connection that under atmospheric conditions unpolluted fresh water can hold only extremely small quantities of oxygen in solution, even when completely saturated at atmospheric pressure with that gas. Thus 100,000 c.c. of fresh water when saturated with the gas at 60 deg. Fahr., and under ordinary atmospheric pressure, holds only 1 gramme of the gas in solution; while a similar volume of unpolluted sea water can hold still less—only 0·8 gramme—under like conditions.

The actual amount of dilution required by crude sewage, or by partially or by wholly purified sewage matter, has been investigated by the Sewage Commission, and their recommendations regarding the question have been published in their Eighth Report.

For sewage liquor—that is to say, for sewage from which the suspended solids have been removed by efficient sedimentation tanks—the commission recommend a dilution with from 300 to 500 volumes of water of a quality which they define by a certain standard chemical test, and which they term "clean" water.

In the case of a sewage liquor from which the suspended solids have been previously removed by chemical precipitation, they do not require so much dilution—only 150 to 300 volumes of "clean" water.

A sedimented sewage liquor would hold light fermentable organic solids, mostly in the colloidal condition, in suspension, as well as fermentable organic substances in solution; but its combined organic content of a fermentable character would not exceed, on an average, 30 parts by weight per 100,000 parts of the liquor.

Hence, when such a liquor is diluted with 300 times its volume of "clean" water—the minimum dilution recommended by the Sewage Commission—the mixture would only contain about 1 part of fermentable organic material per 1,000,000 parts of water.

It is of great practical importance to the engineer to note that when sewage liquor is thus largely diluted, the absorption of dissolved oxygen from the diluting water proceeds at an extremely slow rate, so slowly, indeed, that, in order to detect it by means of a chemical test, a sample of the diluted liquor must be kept in a suitable vessel out of contact with air for several days. To be precise, the total loss of dissolved oxygen shown by a sample of sufficiently diluted sewage liquor, when kept out of contact with air for a period of five days at 65 deg. Fahr., will not exceed 0·4 gramme per 100,000 c.c. of the water.

The rate at which the dissolved oxygen would be replenished in the diluting water and sewage liquor by absorption of fresh oxygen from the air, when exposed to the natural conditions of the stream, would in the case of most rivers and inshore waters be at least equal to the rate of loss indicated by this analytical figure. Hence it may be concluded that, when the discharge of a sewage liquor into a "clean" water stream is properly controlled and limited, it should not, after it has been sufficiently diluted by the waters of the stream, cause an appreciable reduction of the oxygen content of the same waters.

Such, in brief, are the more important bio-chemical principles which underlie the dilution method of disposal for normal sewage liquor.

DISPOSAL OF SOLID MATTERS.

Adverting now to the question of the disposal of the solid portions of sewage matter, it will readily be understood that water bacteria cannot be relied upon

to "mineralise" them when they are discharged into a stream in the same efficient and innocuous manner as they can be in the case of the sewage liquor, simply because these solid portions cannot in like manner be broken up and attenuated by the waters of the stream to anything like the extent of 1 part per 1,000,000, and cannot therefore be adequately supplied with dissolved oxygen during any fermentative change exerted upon them by water bacteria.

If the stream into which they are discharged be not sufficiently rapid to transport and to disperse them through large volumes of "clean" water, or over large areas of clean bed, they will be deposited more or less rapidly along the bed; and if they remain there undisturbed for a few days, they will encourage the growth of myriads of water bacteria in and about their mass; and since their fermentable organic constituents would be in large excess of the dissolved oxygen in the water about them, they would undergo anaërobic fermentation, with the attendant formation, as above described, of the offensive gas, sulphretted hydrogen, of the black sulphide of iron, and possibly also of offensive deoxygenated organic substances, the sulphuretted hydrogen and sulphide of iron being more largely formed in the case of sea waters than in that of non-tidal waters, inasmuch as sea waters hold larger quantities of sulphates in solution.

These products of anaërobic fermentation will tend to poison the bed of the stream in the immediate neighbourhood of the deposited solids, and the extent of the injury would depend upon the area of bed covered by them. It is well to remember that comparatively small areas of solid deposits may, if disturbed from time to time, very distinctly reduce the oxygen content of large volumes of waters flowing over them. When, for example, the putrescent solids become disturbed and distributed through the water flowing over them by a freshet in a river after dry weather, or by a spring tide following a neap tide period, they would absorb in a few minutes more or less completely the dissolved oxygen of the water through which they were dispersed, owing to the great chemical affinity which the anaërobic products, above enumerated, possess for dissolved oxygen.

In order fully to appreciate the very serious injury which sewage or other refuse solid organic materials are capable of causing in a stream, it is necessary to understand the wide difference of their behaviour towards the dissolved oxygen of any water through which they become dispersed when (1) in the fresh condition, and (2) after undergoing bacterial fermentation under anaërobic conditions when deposited for any length of time along the bed or banks of a stream.

Sewage or refuse solids in the fresh condition, like fresh sewage liquor, when dispersed through large volumes of "clean" water, do not directly combine with the dissolved oxygen, but are only induced to do so indirectly and gradually under the influence of any water bacteria that may feed upon them.

When, however, the same solids, after remaining deposited on the bed of the stream for any length of time, and undergoing anaërobic fermentation, become dispersed through "clean" water, the sulphides and deoxygenated organic bodies now mixed with them will directly combine with the dissolved oxygen immediately they come in contact with it. So that, while the waters of a "clean" stream may transport sewage or other refuse organic solids in the fresh condition, and may carry them for several hours without suffering any appreciable reduction in their dissolved oxygen content, the same solids, after remaining deposited along the bed and banks of a stream, and there undergoing anaërobic fermentation, will, when disturbed and dispersed through a like body of "clean" water, immediately absorb the dissolved oxygen of the water by direct chemical combination with it.

INJURY TO RIVERS.

Many of our rivers in this country suffer more or less serious injury from sewage solids in the manner here described. The writer has had opportunities of carefully investigating the condition and circumstances of several of such rivers, and he has given detailed description of some typical examples in the Appendix VI. to the Fifth Report of the Sewage Commission (see pp. 89-91, 269-303, 325-341 and 380). Reference may also be made in this connection to the 1912 report of the Metropolitan Sewerage Commission of New York, pp. 99-117, and also to the 1914 report of the same commission, pp. 232-234.

It will suffice to give here, by way of illustration, one typical example. The Yorkshire river Ouse for a great part of its course is a fairly clean, natural stream. In spite of some rather considerable pollution by the sewage of towns and villages, there is nothing in its waters to prevent or destroy fish life. But near Goole, where it is joined by the Aire and Don, it becomes at times seriously polluted by putrescent sewage solids brought down to it by these tributaries during freshets. It is a matter of yearly complaint that the gross pollution of the upper reaches of these streams occasionally poison and deoxygenate the waters of the Ouse, and prevents the passage of salmon trying to ascend it from the Humber.

Both the Aire and the Don, between their most polluted reaches and their junctions with the Ouse, flow through courses of considerable length, and along which they receive little further pollution, and in which the bio-chemical oxidation of liquid sewage organic matters that had become mixed with their waters is very considerably advanced.

But both tributaries, it must be remembered, are very grossly polluted along their higher reaches. Thus the Aire, with its nearly equal effluent the Calder, drain an area within which lie the towns of Bradford, Leeds, Huddersfield and Wakefield, and villages in which the woollen trade of the West Riding of Yorkshire is carried on.

During dry weather crude sewage solids are deposited along the beds and banks of the upper reaches of these rivers, but the liquid portions gradually undergo fermentation as they are borne along by the waters of the rivers, and the writer has found that, by the time they reach the Ouse in dry weather, practically the whole of the dissolved sewage organic substances originally present becomes completely fermented, and that the second stage of fermentation—that is, the bio-chemical oxidation of the ammonium compounds—has been well established.

But during freshets the sewage solids which had accumulated in dry weather in these rivers, and had meanwhile become putrescent, are washed down into the Ouse, and absorb the dissolved oxygen of its waters, so that the waters are rendered incapable of supporting salmon and other fish life.

These solids also become deposited along the banks of this part of the Ouse and temporarily discolour it. The banks of the river are steep and uncovered at low water. They are overlaid with clay and fine sand, which, as just stated, becomes discoloured after freshets, but appears of a clean yellow colour during dry weather. A good deal of this solid polluting matter, however, remains imbedded in the clay below its surface, and causes further injury to the waters of the river, as will appear from the descriptions that follow.

The Ouse and its tributaries the Aire and the Don are influenced by tides for considerable distances above Goole. The rate of flow and ebb in this portion of the river Ouse varies very greatly during spring and flood tides. At spring tides the flood lasts about 2¼ hours, with an ebb of 9¼ hours, and a period of quiescence of about half an hour at high and low water. At neap tides the flood lasts for four hours, and the ebb for 7¼ hours.

At spring tides the river at Goole rises from 16 ft. to 20 ft., while at neap tides the rise varies between 10 ft. and 13 ft.

The great and rapid rise of the river during spring tides must obviously produce a strong scouring action on the banks of the river, and a much stronger action than at neap tides, when the river rises more slowly and to a less height.

TIDAL INVESTIGATIONS.

Dr. Maclean Wilson has published some valuable and instructive results of some careful investigations that he has made on this portion of the river Ouse during spring and neap tides, and his chemical analyses show that the suspended matters carried by the waters of the river is very much greater during spring tides than during neap tides—the maximum range being 1,100 parts suspended matter at spring tides to 75 parts per 100,000 parts of water during neap tides.

Notwithstanding the fact that the liquid sewage matter in the river is diluted with very much larger volumes of clean water at spring tides than at neap tides, the dissolved oxygen content of the river waters during spring tides is nevertheless considerably less than at neap tides. The only possible explanation for this apparently anomalous state of things is that the clay and sand which are disturbed by the tidal currents in this portion of the river contain putres-

cent sewage solid matters, and that these matters are more effectually scoured and dispersed in larger quantities through the tidal waters by the spring tidal currents than by the neap tidal currents, and that these putrefactive matters rapidly absorb dissolved oxygen from the tidal waters as they become dispersed through them.

As regards the possibility of liquid sewage matters contributing to an appreciable extent to the exceptional deficiency in the dissolved oxygen content of the spring tide waters of the river, several reasons may be advanced to show that this is impossible. For example, Dr. Maclean Wilson's analytical figures show that the proportions of liquid sewage matters in the spring tide samples are about ten times less than those in the neap tide samples, and that, nevertheless, they show a greater deficiency in dissolved oxygen. Some of the spring tide samples were so slightly polluted by liquid sewage matter that they contained no ammonia, and yet, notwithstanding this, their dissolved oxygen content had been so greatly reduced that they were no longer able to support salmon and other fish life; while the neap tide samples, though they contained very decided quantities of ammonia, indicating distinct pollution with liquid sewage matter, their oxygen content was not so largely reduced. It was, in fact, usually above the minimum required by salmon and other fish life.

Sufficient has perhaps been stated in the foregoing pages to indicate the great danger of discharging sewage solids into streams, the currents and physical circumstances of which are not such as to ensure the satisfactory disposal of such sewage matter.

In every such case the sewage solids should be removed before discharging sewage liquor into the stream.

Streams are to be met with, however, which are capable of satisfactorily disposing of the solids as well as the liquor of crude sewage matter; and it becomes interesting and instructive to consider what may become of the solid matters when discharged into such streams. But little attention has hitherto been paid to this question by engineers and chemists. A good deal of information has, however, been obtained concerning it from recent investigations by water biologists.

In the case of such streams the volume and flow of their waters are sufficiently great to prevent the permanent deposit of the sewage solids discharged into them at any particular point, and to distribute them widely through large volumes of water or over wide areas of clean bed. Under these conditions neither the waters nor the bed of the stream can become fouled, and the former will remain well stored with dissolved oxygen. Other forms of organisms besides bacteria will then flourish, and will feed upon the organic solids thus widely distributed through the waters, or over the bed of the stream.

MICROSCOPIC ORGANISMS.

Some of these organisms possess the mode of nutrition characteristic of animal forms of life, and do not consequently exercise by their vital processes the drain upon the supply of dissolved oxygen in waters by causing an oxidation of food materials in the way that bacteria do. They consequently do not require so much oxygen for like quantities of organic matter consumed. They can, moreover, it is well to bear in mind, only continue to thrive in well oxygenated water. They are to be found among the forms attached to the bed of the stream—*e.g.*, annulosa, mollusca and large crustacea; among the micro-organisms, which, by reason of the minuteness of their size and feeble powers of locomotion, are carried about passively by the waters of the stream, and include animal organisms, invisible or barely visible to the naked eye, as well as the two great classes of saprophytic and nitrifying bacteria already considered; and, finally, among the various forms of animals—*e.g.*, fish (pisces)—which freely roam through wide areas of water.

The above three categories of organisms occur more or less abundantly in clean river and inshore tidal waters that are exposed to a pollution slight in extent relatively to their volume and flow from agricultural or domestic drainage, and all may assist in the work of the destruction of the solid organic refuse matters in such waters.

The microscopic organisms of fresh and salt waters —termed collectively the "plankton"—have been shown to play a very important part in the consumption of solid refuse matters in waters. These minute organisms are nourished by a true animal mode of nutrition—that is to say, they absorb solid particles of organic foodstuff at any point on their surface—as in the case of the simplest protozoa, digestion taking place within the cell; or, as in the case of organisms higher in the scale of life, they possess a distinct oral aperture, through which the solid particles enter, and an anal aperture, through which undigested portions of food are expelled.

Besides the protozoa, minute crustacea abound in the "plankton" of waters, and of these the most important in sea water are the copepoda. These organisms lead a predatory life, and well deserve the name of scavengers. They feed largely on sewage, and convert sewage into good food for fish. The rotifera also plentifully occur among the "plankton" of fresh water.

Thus, in the "plankton" of a water organisms exist which in their several ways and by their joint action are capable of completely consuming any sewage matters, liquid or solid, that may be associated with them, always provided that the waters shall at all times be well supplied with dissolved oxygen throughout their mass.

That minute organisms possessing a true animal mode of nutrition can consume the solid organic matters of crude sewage at an extraordinarily rapid rate under sufficiently favourable conditions has been proved by the experiments recently carried out in America by Messrs. Edward Barlow and F. W. Mohlan on the "Purification of Sewage by Aeration in the Presence of Activated Sludge" (Journal of Industrial and Engineering Chemistry, p. 318, Vol. 7, 1915). In these experiments crude sewage was nitrified in five hours, and the biological examination of the purified sludge from these experiments showed that among the microscopic animals found were many vorticella and rotifera, but that the predominant organism is a minute worm—Aeolosoma hemprichi. This organism abounds in various kinds of fresh-water streams, where there is an abundance of decaying organic material, and thrives especially well where there is much fermentation in waters contaminated with sewage, provided that there is an abundance of oxygen. It belongs to a group of worms in which reproduction occurs very rapidly by asexual methods. It must be noted, however, that, although the purified sludge from the experiments was free from unpleasant odour, and continued to be so, so long as these and other organisms, of which it largely consisted, remained alive or in a fresh condition, it nevertheless became offensive when these organisms died and suffered putrefaction. These experiments afford, therefore, a good illustration of the superiority of water bacteria as scavengers over organisms that are nourished by a true animal mode of nutrition so far as end products are concerned.

SEWAGE MATTERS IN STREAMS.

But it may be urged that, even when sewage matters are discharged into streams under the most favourable conditions for their satisfactory purification, their destruction as such by living organisms will not be effected immediately, but only after extended periods of time. So that, if any poisonous bodies be associated with the sewage matters, the waters of the stream may remain poisoned for a considerable portion of their subsequent flow.

This aspect of the sewage dilution problem has also been very carefully investigated of recent years, especially by Dr. Houston, for the Sewage Commission, and for the Metropolitan Water Board, and his very elaborate and prolonged investigations have clearly shown that the dangers of a properly controlled and limited pollution of a stream by sewage matters are not necessarily as great as has been hitherto supposed. He has shown, on the contrary, that the view hitherto held that a polluted river water, such as the Thames, may be at all times dangerously infected by disease germs is not founded on fact; but that the real danger to guard a river water against, in the interests of public health, is the accidental intrusion of specifically infected excretion from disease carriers.

This conclusion, it may be incidentally pointed out, is entirely supported by the immunity from specific diseases of communities dwelling or working alongside of tidal and non-tidal waters that are polluted often to a considerable extent with sewage matters, and in the habit of making use of such waters for boating and other purposes, including domestic use, except that of drinking.

The subject has been authoritatively dealt with by the Sewage Commission in no less than three of their reports (Fourth, Fifth, and Eighth). Thus in the

Fifth Report, when considering the question of the desirability of sterilising sewage effluents before allowing them to be discharged into a stream, the commissioners expressed themselves as satisfied, from experiments carried out for them by Dr. Houston, that it is a practical possibility, although a costly one, to render sewage effluents fairly pure, bacteriologically, by special treatment with chemical sterilising agents; but they add that they found themselves unable to recommend the general adoption of such special treatment, because they feared that a false sense of security would obtain if they did so unless at the same time storm overflows on sewers were also abolished a suggestion that so far appears to be outside engineering possibilities, and because they were also satisfied that rivers generally, those traversing agricultural as well as those draining manufacturing or urban areas, are necessarily exposed to other pollution besides sewage.

They therefore considered that, when a river water is drawn upon by a local authority for a potable water supply, that authority "must be held to be aware of the risks to which the water is exposed, and that it should be regarded as part of the duty of that authority systematically and thoroughly to purify the water before distributing it to their customers."

Apart from possible infection by disease-producing germs, there is no reason for supposing that normal sewage matter can directly exercise any poisonous influence in a stream, especially when extremely small proportions in which they may be safely mixed with the water are borne in mind. As a matter of fact, all observations that have been made on the subject show that such matters exercise a beneficial effect upon the normal life of a stream when their discharge into it is properly limited and controlled.

Antiseptics and certain trade waste liquors would certainly exercise a poisonous influence in a stream if directly discharged into it in the raw condition, or if allowed to drain in too large proportions into a sewer; and where necessary such wastes must be specially treated before being discharged into a stream.

But it is the common experience in sewage purification works of towns in which bacterial processes are carried on—*e.g.*, percolating and contact beds filtration processes—that they are not present in sufficient quantity to interfere with the purification of the sewage matter. No doubt they gain access to sewers, but by the time the sewage reaches the purification or outfall works they have either been destroyed or have been so largely diluted as to be rendered harmless to living organisms.

Although the experimental investigations and views referred to in the foregoing pages all go to free slightly polluted river waters from the odium attaching to them as being necessarily sure sources of disease-producing bacteria, the writer wishes emphatically to support the view that, when any river water is drawn upon for a potable water supply to a community, every possible means should be adopted for guarding against the danger of accidental infection, and for ensuring a sufficient chemical purity of the water for all the purposes incidental to the varied requirements of such community.

This discussion of the dilution method of sewage purification may perhaps be fittingly concluded with the following definition of the term "normal" sewage: "Normal" sewage matters are refuse matters, the fermentable organic constituents—both in solution and in suspension—of which can be purified, without previous treatment of any kind, by living organisms.

Sale Town Hall and Public Offices.—The new town hall and public offices of Sale, including a fire station to accommodate the Sale and Ashton-on-Mersey Joint Brigade, were formally opened on Saturday by Mr. Ernest Jones, chairman of the council. The buildings have been erected at a cost, including furnishings, of £41,000, and for their size are considered to be among the best of their kind in the North of England. The architect was Mr. C. T. Adshead.

Bo'ness Electricity Works.—The Secretary for Scotland has written offering no objection to the scheme of the Bo'ness Town Council for an extension of the burgh electricity works. The proposed works, which would enable the undertaking to meet the demand during the ensuing winter for munitions of war, are estimated to cost between £6,000 and £7,000. The town council have asked the National Electric Construction Company, Limited, London, to submit plans, specifications, and prices of the proposed work.

CORRESPONDENCE.

Εἰς ἀνὴρ οὐ πάντ' ὁρᾷ.
(One man does not see everything.)
—EURIPIDES.

THE ACTIVATED SLUDGE SYSTEM OF SEWAGE PURIFICATION.

To the Editor of THE SURVEYOR.

SIR,—I notice in your editorial, p. 562, that you say that, while we are waiting for investigations, our friends in America, recognising the great value of this process, have already commenced experiments. The experiments of Mr. T. Chalkley Hatton, to which you refer, have been carried out at Milwaukee in collaboration with me, my services being retained for this purpose twelve months ago. I am also officially in touch with experimental work at the University of Illinois and at Edmonton, Alberta.

Further, thanks to the enterprise of a British firm —Messrs. Jones & Attwood, Limited—a large amount of pioneer work has been done in this country, and many patents taken out during the last three years, not only in England, but also in the U.S.A. and many other countries. This firm have just completed an installation on the "fill and draw" principle for the Baguley Sanatorium of the Manchester Corporation. It is now in operation, and the results are being carefully watched. They have also taken all the responsibility for, and are carrying out, large permanent works at Stamford and Worcester, both on the continuous system. The Milwaukee tank is to treat 1,600,000 U.S. gallons (1,330,000 imperial gallons), but the tank at Worcester will treat 2,000,000 gallons.—Yours, &c.,

GILBERT J. FOWLER.

The Frankland Laboratory,
Chemical Department,
The University,
Manchester.
December 7, 1915.

[We are glad to learn from Dr. Fowler's letter that works for treating sewage on the above principle on the continuous system are being constructed in this country, but it must be some time before any results are available. Meanwhile, the results obtained at Milwaukee have been published. It is also satisfactory to note that the experiments at Milwaukee were carried out in collaboration with Dr. Fowler, and this was clearly stated in Mr. T. Chalkley Hatton's first report, which was printed in our issue of September 3rd last (p. 258). Messrs. Jones & Attwood, Limited, of Stourbridge, who have also written us on this subject, point out that the first experimental tank put down at Milwaukee was designed in their office. Mr. Chalkley Hatton, they state, afterwards designed a continuous tank with simple air lifts, but found their diffuser arrangement in the first tank superior, and eventually adopted and fell back on their arrangements. The firm add that the process is the invention of Dr. Fowler and his colleagues, that the apparatus adopted in the experiments, both in this country and America, are of their design, and are now patented all over the world, and that thus the American experiments are subject to these patents. Therefore, they add, it is a thoroughly English enterprise in every respect. Ed. THE SURVEYOR.]

INSTITUTION OF MUNICIPAL ENGINEERS.

NO. 1 (NORTHERN) DISTRICT MEETING.

A meeting of the No. 1 (Northern) District of the Institution of Municipal Engineers will be held in the Town Hall, Newcastle-on-Tyne, to-morrow (Saturday), at 2.30 p.m.

AGENDA.

1.—To confirm minutes of last meeting.
2.—To consider the presentation to Mr. John Robinson.
3.—To consider suggestions by Mr. Winter Gray on the administration of the Mutual Aid Defence Fund.
4.—To receive report of council, and papers read at annual meeting.
5.—To elect chairman and secretary for 1916.
6.—To fix date of annual meeting and appoint subcommittee.
7.—Any other business.

A Healthy Urban District.—Not a single death occurred in the urban district of Bulkington during the month of November.

Institution of Municipal and County Engineers.

EASTERN SUB-DISTRICT MEETING AT BURY ST. EDMUNDS.

In the absence of the president and chairman of the district, Mr. H. T. Wakelam (Middlesex), Mr. A. E. Collins (Norwich), past-president, occupied the chair at the Eastern Sub-District meeting (Suffolk, Norfolk and Cambridge), held at Bury St. Edmunds on Saturday afternoon last. The proceedings took place in the Shire Hall, and those present included Messrs. J. H. Clarke (Haverhill), R. Croome (Cromer), H. Collins (Colchester), district secretary, A. D. Entrals (Thedwastre), W. H. Eley (Newmarket), J. H. French (Harwich), T. Gann (Harwich), P. T. Giles (Bury St. Edmunds), S. C. Gordon (London), W. D. Harding (Bury St. Edmunds), G. Harrison (East Stow), W. L. Jenkins (West Suffolk), J. Inman (Cambridge), G. W. Lingwood (Stowmarket), S. C. Lloyd (East Suffolk), S. Matthew (Chelmsford), J. R. Mead (Ipswich), hon. sub-district secretary, H. Miller (East Suffolk), T. W. Morgan (West Suffolk), R. S. W. Perkins (Ely), A. J. Smith (King's Lynn), J. A. Webb (Hendon), and S. A. Hill-Wilks (Tilbury).

On assembling the members were received by Mr. W. Lionel Jenkins, the county surveyor, and in the course of the subsequent business it was announced that further meetings of the sub-district had been arranged to be held at Yarmouth on April 8th, Cambridge on June 3rd, Sheringham on July 29th, and Stowmarket on September 30, 1916. A cordial vote of thanks was passed to Mr. W. D. Harding, the borough surveyor of Bury St. Edmunds, for his kindness in having granted facilities earlier in the day for the inspection by a number of the visitors of the waterworks, electric power station, and refuse destructor.

A paper entitled

WAR-TIME ECONOMY BY LOCAL AUTHORITIES

was afterwards submitted by Mr. William H. Eley, ASSOC.M.INST.C.E., engineer and surveyor to the Newmarket Urban District Council.*

The CHAIRMAN (Mr. A. E. Collins), in opening the discussion on Mr. Eley's paper, remarked that the better one's administration the more difficult it was to effect savings, except by dropping work altogether. He adopted motor haulage in Norwich twelve years ago, and the more experience he had with it the more he felt inclined to extend it. The difficulty, however, as Mr. Eley had said, was to find the necessary capital. For towns the best form was electric haulage, but to make any form of haulage pay one must have quick filling and discharge. With one steam wagon which he had had in service twelve years the cost worked out at from 10d. to 1s. per ton-mile, with loading only one way. Another wagon, of a ton larger capacity, which had been in use a few years less, the figure was 8½d., and in the case of another still newer wagon of 6 tons capacity, the cost was less than 6d. per ton-mile. For horse haulage the cost was 1s. 6½d. His view was that with a really good electric wagon the work could be done for less than 6d. per ton-mile. When considering the introduction of mechanical traction one must, however, bear in mind the question of quick loading, and he had come to the conclusion that generally the best thing to do was to supply areas with a sufficient number of skips or tipping buckets, and to have a crane erected on the wagon so that the skips or buckets could be quickly handled. At the same time, he considered that a self-contained motor and wagon was better than a separate tractor and wagon. Touching on other points in the paper, Mr. Collins said he should like some more information on the subject of the furnace bars which had been referred to, as well as with regard to the mixture of chalk and coal dust used for fuel. He added that it seemed to him quite the proper thing to do to cultivate the unused ground in cemeteries. In Norwich it was the practice to consecrate only a portion of the cemetery ground at a time, and let the rest for allotments. His borough had reduced the expenditure on highways from £54,000 to £32,000 a year, and the result was that he was starving the roads; there was nothing else for it. He did not know what was going to happen if they went on like that. It took twenty-two years to get them into decent condition, and he supposed they would now go back to a condition worse than they were when they started.

Mr. J. W. COCKRILL (Great Yarmouth), in a communication on the subject of the paper, stated that, with highways, as early as January his committee decided to cut £4,000 out of the estimates for remaking roads, and in the ordinary light repairs they allowed him to carry out some £600 worth of tarring against £250 in previous years, the £350 thus spent to be saved out of general repairs. In this way he was of opinion that, with the decreased traffic, little or no damage would result for this one year; but it would look very serious if the process was continued. Starving the roads was false economy. Tarring will to some extent help, and his experience went to prove that the saving by tarring was quite 33 per cent, and yet one of the leading daily papers, in trying to teach the local authorities how they should economise, described the tarring going on as dreadful waste. Formerly £5,600 was spent on street lighting in Yarmouth; the committee, before the present lighting regulations, reduced this to £4,000. The lighting regulations turned out every lamp, but as there were capital charges and repairs to be met, the cost would now be £1,500, reducing the bill £4,000; and he thought that, as the public had found it possible to live without so much light, it was very likely that it would be some years before the lighting bill again reached £5,600. One thing in Mr. Eley's paper that he would like to emphasise was that there was enormous economy in carrying out haulage and cartage by steam or motor wagons. Just before the war commenced Yarmouth purchased three of these vehicles. He used them for all the long-distance work, with the result that there was a saving of quite 40 per cent of the cost of the work over their own stable or under their haulage contracts. One clause in Mr. Eley's paper he disagreed with—viz., the last but one. If the local authorities were to set a bad example in the matter of the parsimonious treatment of their building, they had better do as he recommended in the last paragraph—"shelve them," and wait for the good times coming.

Mr. E. WILLIS (Chiswick), in a written communication, said he was in entire agreement, subject to certain reservations, with the suggestion that economy might be effected by mechanical contrivances. It should always be borne in mind that motor traction, whether by steam, petrol, or electricity, was most economical in large districts, where long journeys were necessary; but in small areas, where the time loading, such as in picking up slop and collection of house refuse, was very large in comparison with the time travelling, his experience had always proved that motor traction might be efficient, but was certainly not economical. Probably the greatest economy in this method of traction was obtained in fire brigade work, which could be closely followed by watering, if an ample supply at good pressure were obtainable, and vacuum gully emptying; but for house refuse collection, slopping, and similar work, he thought horse traction was both preferable and more economical. He was not quite in agreement with Mr. Eley in regard to dropping all expenditure upon tennis courts, bowling greens, &c., at the present time, since it would be unreasonable to expect a monetary return from these if they were not maintained; while, if they were properly maintained, not only were the amenities of the recreation ground or park improved, but a better income would probably be obtained. Probably all members would agree with Mr. Eley as to his general remarks on refuse collection and disposal; but it might be of interest to some of those present to know the method adopted in Chiswick, which had resulted in a considerable saving, amounting to several hundred pounds. In lieu of letting the collection out to contract, or, alternatively, utilising the direct labour system, the council had adopted a combination of the two—the council actually supplied horses and vans of large capacity, and then paid the carmen and an equal number of collectors at piece-work rates on the total weight collected. His original rate was 2s. per ton collected, but, owing to there being upwards of 1,000 tons less as the result of ratepayers trying to burn more themselves, and less waste since the war started, the pay of the men was materially

* See page 598.

affected, and the council consequently increased the rate to 2s. 3d. If the carmen and dustmen had finished their collection before the end of the week, the latter were given ordinary labourer's work, similar to the regular men of the council; while the carmen also finished on general work, being all paid on day-work rates, and all were treated as permanent employees, with the same benefits and holidays as day-work men. The complaints as to non-collection were nominal, as the dustmen had instructions to leave a card stating that they had called and when the next collection would probably be made. In regard to painting and decorating, he found, in connection with the education work and public buildings, touching up of defective places properly, and giving one and, in some cases, two coats over small areas, would enable the heavy expense of repainting external work throughout to be deferred for another two years. This was an important item in connection with school buildings especially. Under the heading of depots and stores, he would sound a note of warning in regard to continuing the use of hand-brooms too long. Waste of labour by using a short, bristly broom would often result, and be much more costly than scrapping a broom and giving the scavenger a new one. While he was in principle in agreement with all Mr. Eley had said under this heading, a good deal of discretion was needed, and the practice adopted by him for some years past was for the storekeeper to keep what tools were, in his opinion, worn out, and he (Mr. Willis) periodically inspected them prior to their destruction. In many cases it has been possible to re-use some originally thrown out by the men or even by the storekeeper.

Mr. F. Hall Smith (Sheringham) wrote that the placing of dustbins outside premises in seaside resorts would be undesirable.

Mr. J. A. Webb (Hendon) mentioned that in his district they had reduced the public lighting by practically 80 per cent.

Mr. H. Collins (Colchester) observed that the subject of war-time economy by local authorities was one of very great interest at the present time, and was one which would leave its mark after the war. There were many economies now being effected which should have been in force before the war. Owing to Colchester being a garrison town, and consequently having a much increased population at the present time, the cost of many of the services, such as sewage pumping and treatment, removal of refuse, and so forth had increased. Certain economies had been made, however. In street watering, for instance, he was able to reduce the cost from £705 in 1914 to £240 for 1915. Of course, complaints were received as to lack of watering, but not more than in a normal year, as people were beginning to appreciate the fact that they must be content with a lower standard for this service, at any rate. In connection with the removal of refuse, he circulated among householders a notice which fully attained its object, as though at one time there were, he believed, many thousands of soldiers in billets, in addition to those in the huts and barracks, they were able to clear the refuse as usual, with only the necessity of occasionally putting on an additional cart. Previous to the war all waste paper in Colchester was collected by the Salvation Army, who sold it, but they were quite unable to do so after the war broke out, and the council had to render this service now, charging 1s. 6d. per load, and requiring it to be tightly bagged, the council finding the bags. There was a very distinct economy in this, besides which it prevented a nuisance through paper blowing about the street. A better course still was baling by means of a hand press; but it was difficult to persuade business people to go to the expense of installing a machine. His experience of sorting out tins was that it was not worth the expense, as the railway carriage swallowed up most of the money obtained for the material, leaving insufficient to pay for the labour in sorting and flattening out by means of a steam roller. In connection with sewage pumping and treatment works, it was a distinct economy, in even small stations, to have a thoroughly trained mechanic in charge, as much of the repair work could be done by him or the staff under his supervision. In addition, it is necessary for the borough engineer to keep very closely in touch with the work at the works; at the present time he was carrying out, at a cost of between £40 and £50, repairs which would formerly have been done by an outside firm at a cost of probably not less than £200. Where sludge was treated with lime and pressed it was very often possible considerably to reduce the quantity of lime used without lowering the efficiency of the work; he had been able to reduce the lime used at his works by at least 3 tons per week. Another source of waste at outfall works was too great a percentage of slip in pumps. On testing his own pumps he found it was double what it ought to be, and was 23 per cent; but, of course, the percentage of slip with bucket and plunger pumps and ordinary retaining valves was bound to be greater when pumping sewage as compared to clear water. They were in such a position in Colchester that they were enabled to make a very large saving in connection with the public lighting, the annual cost, which was £3,518 immediately previous to the outbreak of war, having been reduced to £315. Most of his men were able to find other work, and he had retained four, including the lighting foreman. These were necessary for the maintenance of the lanterns, &c.; they also did all whitewashing of kerbs, painting of white bands and luminous paint bands on lamp columns and corner posts, &c. He now required the foreman, who was a gasfitter by trade, to do most of the plumbing and hot-water work required, thus saving outside bills. They took full advantage of the moon in considering the lighting table for the year, and thus considerably reduced the hours of burning per year. He was of opinion that further economies could be made in this respect—for instance, their lighting table for the current year provided for lighting in April, September, and October up to hours varying between 1 a.m. and 3.30 a.m.; he did not think there was any real necessity to light in these months after midnight. He quite agreed with Mr. Eley as to the hiring out of plant not required at the moment, and had been able to make hundreds of pounds during the past twelve months by hiring out lighters, steam dredgers, pile drivers, barrows, steam rollers, water carts, &c., to the Admiralty, War Office, and others. He also quite agreed with Mr. Eley and Mr. Cockrill as to the economy of road tarring, and had been able to maintain roads in fair condition by patching and surface tarring, which previous to his going to Colchester had been arranged to be resurfaced with tarmacadam this past spring and summer. Portions of these roads would gain an extended life of two years. He should like to ask Mr. Cockrill whether he had considered the question of using electric wagons, as he was of opinion they would be very suitable for his district. There was no doubt in his mind that, by keeping mechanical vehicles on suitable work and arranging for quick loading and unloading facilities, there was a very big saving over horse haulage.

Mr. S. A. Hill-Willis (Tilbury) admitted that in many districts it was possible to fall in with the suggestion to reduce expenditure on road making and repairs to roads because of the decreased traffic for general purposes since the commencement of the war; but with Tilbury the reverse was the case. Owing to the war, transport work at Tilbury Docks had considerably increased in volume and importance, and this entailed a proportionate increase in heavy road traffic, and the consequent wear and tear of the surface of the roads. It was essential in the national interests that this special traffic should be facilitated rather than impeded, and for this reason it was impracticable for the Tilbury Council to make any reduction in their road maintenance expenditure in respect of their principal highways. On the other hand, it was obviously unreasonable that the whole of this additional expenditure, which was for national purposes, should fall upon the local ratepayers, instead of being borne by the National Exchequer. He had therefore recommended the Tilbury Council to apply for a special grant to enable a good standard of road maintenance to be maintained. With reference to the remarks by Mr. Collins, he had during the past year hauled several thousands of tons of materials for district and military roads by both steam and petrol lorries, and found that he had been able to haul by means of 6-ton steam tractors and trailers (capacity 5 yds.), for journeys over 1 mile in length, at 75 per cent of the cost of horse haulage. With regard to petrol lorries of 2 tons capacity, and rubber tyred, he found no saving was effected, as they were so speedy in travelling that, in the absence of special loading facilities, much time was lost in that part of the operations.

Mr. R. Croome (Cromer) said he agreed as to the importance of the patching of highways at the present time, but he was afraid that even that operation would become a matter of difficulty, owing to the increasing scarcity of labour. Surface tarring, he agreed, was an undoubted economy. Norfolk

The Surveyor
And Municipal and County Engineer.

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County Council had resolved to discontinue this work next year and save £7,000, but he thought they would ultimately find themselves out of pocket by at least four times that amount. His view was that it was only economy to neglect the grass edges along the roads. As to street watering, they did practically none last year, and, extraordinarily enough, had had no complaints. In regard to the collection of house refuse, he agreed with the author that the placing of dustbins outside contributed to economical working, and had thought of suggesting it himself, but after consideration had abandoned the idea. He was opposed to taking away trades waste without charge.

Mr. H. MILLER (East Suffolk) remarked that, while generally the painting of public buildings might be left alone, it was desirable to look after the eaves-troughing.

Mr. G. W. LINGWOOD (Stowmarket), discussing the question of reduced lighting, stated that in his case, on a contract of £272, the gas company had allowed them a rebate of £188. Any suspension of tarring would, he thought, only result in lowering the standard of the main roads.

Mr. J. JULIAN (Cambridge) pointed out that the use of dehydrated tar increased the cost of tarring operations, owing to the fact that, as compared with crude tar, it did not cover so many square yards. He had therefore slightly reduced the area tarred, and saved the rest of the money on the watering. He had received only three complaints since adopting that procedure. Mr. Julian added that the patching of roads with tar and granite chippings had been found to answer very well on light-traffic roads.

A vote of thanks was passed to Mr. Eley for his paper.

Replying to the points raised by the several speakers, Mr. ELEY said the point he wished to emphasise was that we were not living in ordinary times, and that what might be a necessity in times of peace might not be a necessity at present; accordingly they must look into things and see what was just the barest necessity. He thought it would be useful if they could obtain information from all the members of the Eastern District as to what gas and electric light companies were allowing councils per standard in those districts where public lighting was either severely restricted or prohibited, and particularly what was being done where contracts existed. In his own case there was a contract for £981, and the gas company had allowed them a sum of £200. The presence of troops in his district had had the result of adding to the amount of sewage pumping and making the scavenging more expensive, while the cost of other services had increased; but he was trying to keep down expenditure wherever possible. They charged 1s. 6d. per load for the removal of trade refuse.

Before separating the members were entertained to tea at "Forest Dean," by Mr. Lionel Jenkins, the county surveyor.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not satisfactory to find that the National Physical Laboratory at Teddington is about to instal a Ransome combined drying and mixing machine, with a view to continuing the experiments and tests on bituminous and other road surfaces? Is not this especially gratifying when, owing to the war, it was feared that these useful tests were about to be temporarily discontinued?

* * * *

Will not the Parliamentary Bar and skilled witnesses be rather badly hit this session when we find that there are only fifteen Bills with "plans" deposited in the Private Bill Office, against 158 deposited last year? Will not the saving of money be very large when we consider the immense cost involved in getting a private Bill through Parliament?

* * * *

Is it not a rather curious sign of the times that there appears to be great difficulty in obtaining contractors to tender for road work in Ireland? May not this difficulty eventually be the means of inducing the road authorities of this portion of our kingdom to employ their own staff of men to execute the necessary road repairs?

* * * *

Was Mr. R. Burns Dick prophetic when he gave an address, as president of the Northern Architectural Association, Newcastle, on the bomb-proof city of the future, which would have underground roadways, strongly reinforced flat roofs to the houses, special hangings for art treasures, and underground electric generating stations? Although some people may consider his suggestions fantastic, is it not within the bounds of possibility that, with further developments in aviation, the day may arrive when such precautions will be found to be necessary?

* * * *

Where is Portumna, where the surveyor is said to have reported that the roads were going from bad to worse, and that after another year or so there would be no roads at all in the district? If this forecast is true of the Portumna roads, what is going to happen in other places if the war lasts another year or two?

* * * *

Did not Mr. Henry C. Adams strike the right note in his presidential address to the Institution of Municipal Engineers when he drew attention to the insecurity of tenure of office of the municipal engineer at the present time, and urged more combination and effort on the part of surveyors to secure a more stable position? At the same time, was he not also quite right in saying that a more thorough and scientific training was necessary for men seeking such appointments?

* * * *

Would it not have been well if the Local Government Board, in publishing the fact that 157 members of their staff had joined the Forces since the beginning of the war, had also informed us what proportion or percentage of the "eligible" men this represents? Should we not also like to know if the berths of these patriotic men who have joined are being kept open for them?

* * * *

Have we not arrived at a period in the history of road making when surveyors will be obliged to redouble their efforts to maintain our roads in anything like a suitable condition? Will it not require all their vigilance and ingenuity to maintain the surfaces on a reduced scale of expenditure, and will not the definition of an engineer as "a man who can do for one dollar what any fool can do for two" now be put to the test?

* * * *

Shall we not all be delighted to hear that the Oxford Corporation have at last decided to remove the almost obsolete tramways in the streets of that city and are about to put the streets into a proper condition for the traffic which they have to bear? Is it not about time that something should be done to these streets, which have been a reproach to this city for such a long time past?

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—The rapid increase of sand wastes around our coasts is indeed a serious one, and Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian*

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

517. Venturi Meter.—Describe, with sketch, the construction of the Venturi meter, and explain the hydraulic principles on which it is based. ("Hydraulics.")

518. Strength of Materials.—Explain clearly the meaning of the terms (*a*) stress, (*b*) strain, (*c*) modulus of elasticity. What is the relation between them?

519. Mechanics.—Define the terms "force" and "work done by a force." What are the units of force and work as adopted by engineers in this country? State the relations between the gravitation and absolute units of force and work, and say why the latter units are so desirable for many scientific purposes. ("Student.")

520. Properties of Materials.—Compare the properties of wood and steel as regards the use of these materials for beams. (T. R.)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

514. Water Supply.—A storage reservoir and a service reservoir are situated at a distance of 5 miles apart, and are connected by a 12-in. main, which, at a point 1 mile from the service reservoir, feeds a 10-in. distributing main. The top-water levels of the storage and service reservoirs are 850 and 750 ft. respectively above ordnance datum, and the level at which the distributing main leaves the trunk main is 400 ft. above ordnance datum. When water is passing into the distributing main at the rate of 60,000 gallons per hour, what will be the (1) pressure in the trunk main at the connection with the distributing main? (2) the quantity of water passing from each reservoir towards that point? and (3) the hydraulic gradients from the reservoirs to the junction of the trunk and distributing mains? ("Ionic.")

In approaching this question the first thing to be borne in mind is the fact that no water can leave the service reservoir until the 100 ft. of head (difference of top-water levels of reservoirs) has been used up by friction in the 4 miles of pipe between the storage reservoir and the distributing main. It is clearly evident that this is true, otherwise the water would be flowing against the hydraulic gradient. Considering part (2) of this question first—60,000 gallons per hour = 1,000 gallons per minute. Let us now find the discharge at the distributing main, through the 12-in. pipe, 4 miles long, with a head of 100 ft. This can be obtained by Box's formula, which is as follows:—

$$G = \sqrt{\frac{(3d)^5 H}{L}}$$

where G = discharge in gallons per minute
d = diameter of pipe in inches
H = head in feet
L = length of pipe in yards.

Using logarithms:—

$$\log G = \tfrac{1}{2}[5 \log 36 + \log 100 - \log 7040]$$
$$= \tfrac{1}{2}[7{\cdot}7815 + 2 - 3{\cdot}8476]$$
$$= 2{\cdot}96695$$
$$\therefore G = 926{\cdot}7 \text{ gallons per minute.}$$

∴ 926·7 gallons of water per minute are arriving at the distributing pipe from the storage reservoir before any can come from the service reservoir. The remaining 73·3 gallons per minute come from both reservoirs, and the proportion from each will now be determined.

Let x = gallons per minute to come from storage reservoir, then $(73{\cdot}3 - x)$ = gallons per minute to come from service reservoir. The total quantity of water now coming from storage reservoir = $(926{\cdot}7 + x)$ gallons per minute, and the head H required for this, according to Box's formula, is

$$H = \frac{G^2 L}{(3d)^5}$$

$$\therefore H = \frac{(926{\cdot}7 + x)^2 \times 4L}{(36)^5} \text{ where L = one mile}$$

and the head H^1 required for $(73{\cdot}3 - x)$ gallons per minute from service reservoir is

$$H^1 = \frac{(73{\cdot}3 - x)^2 \times L}{(36)^5}$$

and $(H - H^1) = 100$ feet (since there can only be one pressure in the pipe at the distributing main)

$$\therefore L\left\{\frac{(926{\cdot}7 + x)^2 \times L}{(3d)^5} - \frac{(73{\cdot}3 - x)^2}{(3d)^5}\right\} = 100$$

or $3{,}435{,}091{\cdot}56 + 4x^2 + 7413{\cdot}6x - 5372{\cdot}89 - x^2 + 146{\cdot}6x$
$3{,}435{,}581$
or $3x^2 + 7560x = 5862$
$x^2 + 2520x = 1954$

$$x = \frac{-2520 \pm \sqrt{2520 + 7816}}{2}$$

$$x = \frac{-2520 \pm 2521{\cdot}5}{2}$$

$\therefore x = {\cdot}75$ gallon

∴ the total quantity coming from storage reservoir = 926·7 + ·75 = 927·45 gallons per minute, which is equivalent to 55,647 gallons per hour. The quantity from service reservoir = 73·3 − ·75 = 72·55 gallons per minute = 4,353 gallons per hour.

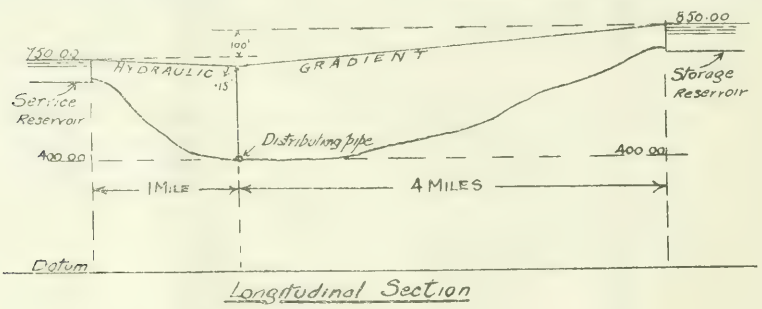


FIG. 1.

Considering (1) the pressure at the distributing main—Let us find the loss of head H in delivering 927·45 gallons per minute through 4 miles of 12-in. pipe, with Box's formula

$$H = \frac{G^2 L}{(3d)^5}$$

$$\log H = 2 \log 927{\cdot}45 + \log 7040 - 5 \log 36$$
$$= 5{\cdot}9345810 + 3{\cdot}8475727 - 7{\cdot}7815125$$
$$= 2{\cdot}0006412$$
$$\therefore H = 100{\cdot}15 \text{ feet.}$$

But the pressure at distributing main equals the available head, minus the head lost = 450 − 100·15 = 349·85 ft. = 151·46 lb. per square inch.

On working out the head lost in delivering 7250 gallons per minute from the service reservoir, through 1 mile of 12-in. pipe, it is found to be ·153 ft.; thus it is seen that the two losses of head differ by 100 ft., and is a check on the accuracy of the work. Fig. 1 shows diagramatically the hydraulic gradient. (J. G. W., *Downpatrick.*)

515. Sewage Effluent.—Litmus paper is sometimes used in trying the quality of a sewage effluent. State how this is done, and also how to determine roughly the quality and purity of a sewage effluent by this means. ("Student.")

We are indebted to Dr. H. T. Calvert, of the West Riding of Yorkshire Rivers Board, for the following:—

Litmus is a natural colouring matter or dye-stuff prepared from various species of lichens. In the commercial form it is a pale blue substance, which is soluble in water, and the solution turns red on the addition of an acid. The blue colour can be restored by adding sufficient alkali to neutralise the acid.

Litmus paper is prepared by soaking paper in either red or blue solutions and drying; red litmus paper is used to test for alkalinity, as it is turned blue on being dipped into an alkaline liquid, and blue litmus paper is used to test for acidity, as it is turned red by an acid liquid.

It will thus be seen that litmus paper can only be used to test the acidity or alkalinity of a sewage effluent, and the test may be more or less quantitative in the hands of an experienced man, who notes the speed at which the paper changes colour and also the depth of blue or red colour produced in a definite time. The litmus paper made by different firms varies to some extent in sensitiveness.

The value of the test to the sewage works manager may be briefly indicated. Fresh domestic sewage is slightly alkaline, and will hence turn red litmus blue; but sewage rapidly undergoes fermentation with the production of ammonia, carbon dioxide, and sulphuretted hydrogen. The ammonia, being alkaline, increases the alkalinity of the sewage, whereas the other two substances, being acid, decrease the alkalinity, and may be produced in sufficient quantity to render the sewage acid. Such is sometimes the case where sewage is allowed to remain for too long a period in septic tanks. It is then more difficult to purify on filtration areas, as the acidity is inimical to the growth of the purifying organisms.

If chemicals are used for precipitation of the sewage, the test is useful in helping to regulate the amounts. With lime, the tank effluent should not be very alkaline, as the excess of lime, besides increasing the cost, deposits on the filters in the form of carbonate of lime. The excess of lime also redissolves some of the organic matter and carries it forward to the filters, which have thus extra work to perform. With aluminoferric as a precipitant, there is a tendency for the tank effluent to become acid if too large amounts are used. This is inimical to filtration areas, and also fosters profuse growths of fungus in any small stream into which the effluent may be discharged.

The effect of filters in the purification of sewage is to reduce the alkalinity. This is due to the disappearance of free ammonia with the production of nitrate, and also to the formation of carbon dioxide, both as a result of oxidation.

Mention should not be omitted of the fact that litmus paper is very useful in testing the crude sewage, especially to see whether abnormal discharges of acid liquids are taking place from waste pickle tanks, dyeworks, explosive factories, or breweries; but in this connection methyl orange paper is more useful, as it is not changed from light yellowish brown to pink by carbonic acid, a natural constituent of the sewage. Alkaline liquids are discharged from tanneries, woollen factories, and other works. In such cases the sewage works manager can often render a service to the manufacturer by drawing his attention to the waste involved by such abnormal discharges.

We are indebted to Mr. G. Bertram Kershaw, M.INST.C.E., of Westminster for the following:—

"Litmus" paper is used to determine whether a liquid is acid or alkaline in reaction. There are two kinds of paper—red and blue. Blue litmus turns red when touched by an acid, and red litmus turns blue when in contact with an alkaline liquid. Neither kind of paper is of any use for determining the degree of purity of a sewage effluent.

NOTES.

J. G. W. (Downpatrick) writes:—

Referring to my reply to No. 510, Axle Stress, published in your issue of 26th inst., I regret that I have made an error in the arithmetic.

The fourth line from the end and the following lines should read:—

$$f_1 = 16\,(67200 + 79255) \text{ and taking } d = 5 \text{ inches}$$
$$= \frac{16 \times 14655}{3{\cdot}1416 \times (5}$$
$$= 5936 \text{ lb. per sq. inch.}$$

SNOW REMOVAL.

DEPTFORD'S CIRCULAR TO HOUSEHOLDERS AND SHOPKEEPERS.

The circular on the subject of snow removal reproduced below has been issued to householders and shopkeepers in Deptford by the borough surveyor, Mr. F. Wilkinson, ASSOC.M.INST.C.E., A.M.I.M.E., who informs us that he has also asked the superintendent of the local labour bureau to register all the women possible for the work and to forward their names and addresses to him.

METROPOLITAN BOROUGH OF DEPTFORD.

TOWN HALL,
NEW CROSS-ROAD, S.E.
December, 1915.

DEAR SIR (OR MADAM),

REMOVAL OF SNOW.

In the event of a fall of snow during the winter, the usual casual labour employed for clearing will not be available, and I am instructed by the council to ask householders and shopkeepers if they would assist by clearing the footpaths in front of their premises, and more particularly the channels of the carriageways; this would allow the water to run away when the snow melts, and would minimise the inconvenience to pedestrian and other traffic.

COLLECTION AND DISPOSAL OF REFUSE.

A circular letter was sent to all householders and shopkeepers in the borough in September, 1914, pointing out the great importance of reducing house and trade refuse to its lowest limits, because of the very considerable difficulty and extremely high cost of collecting and disposing of same.

A further circular was sent out in February, 1915, again urging ratepayers to dispose of as much refuse as possible by burning it, and stating that the compliance with the request of the previous circular had been very slight.

Since then the amount of refuse collected shows a decrease, but there is still a very large proportion of the refuse collected which is easily combustible. I therefore again appeal to you to burn all combustible refuse, especially paper, and so reduce the labour required in collection and the cost of disposal.

The expenditure under this heading for the twelve months ending March 31, 1915, amounted to over £8,000, and I am quite sure that this sum could be reduced by £4,000 if householders and shopkeepers would assist in the manner suggested.

Thanking you in anticipation of your co-operation in these two matters.

I am, Dear Sir (or Madam),
Your obedient Servant,
F. WILKINSON,
Borough Surveyor.

Not only have the difficulties and expenses of refuse collection and disposal been further increased lately, but the Government now insist on the utmost economy being observed by all local authorities.

Councillor Gee Moore, at the last meeting of Stoke Newington Borough Council, called attention to the lack of labour and the difficulty of getting rid of the snow in case of a downfall. Councillor Dod said he thought the residents might be asked to clear their own frontages. He was sure they would be willing to help in this matter under the existing circumstances. Councillor Glass thought an official resolution ought to be posted and advertised. On the suggestion of the mayor the matter was referred to the Highways Committee with power to act.

Twickenham Urban District Council have agreed to issue a notice asking the ratepayers to remove, or cause to be removed, snow from the footways in front of their premises when the necessity arises.

Law Notes.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Editor," at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter X, combinations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.*

BRIDGE OVER CANAL: LIABILITY TO REPAIR.—"Surveyor" writes: Some seventy years ago a bridge conveying a public highway was erected over a canal, the cost being defrayed by private subscription. There is no documentary evidence as to who had to maintain the bridge, and there is no evidence of any repairs having been done at the bridge except the Highways Board having once repaired the roadway. The canal company decline to admit liability, as they allege the bridge was made in substitution for a swing bridge which they constructed when the canal was made, and they gave a subscription towards the cost of the new bridge. Seeing the bridge was erected since 1803, should not the cost of maintenance be borne by the county? There is no evidence of dedication, only it has been used by the public for over sixty years, and is a bridge of public utility.

The general rule of law as to the liability to repair bridges over canals, &c., was stated by Fletcher Moulton, L.J., in *Hertfordshire County Council* v. *Great Eastern Railway Company*, as follows: "Where persons, acting under statutory authority, for their own purposes interrupt a highway by some work which renders it impossible for the public to use it, an obligation is, *primâ facie*, imposed upon them to construct such works as may be necessary to restore to the public the use of the highway so interrupted, and that the obligation so imposed is of a continuing nature, involving not only the construction of such works, but also their maintenance. In order to rebut the presumption that such an obligation is imposed upon them, such persons must show that the statute under the authority of which they were acting contains some provision amounting to an exemption from such an obligation. It is not enough, in my opinion, that the statute is silent on the point." In the present case the application of this rule is very likely modified, owing to the substitution of another bridge for that originally constructed. We are aware of no reported case in which the facts are at all similar, and the party liable may be found to depend upon the precise circumstances under which the new bridge was built.

RECEIPT FOR WAGES: NECESSITY FOR STAMP. "Slurry" writes: Will you kindly inform me if a penny stamp is necessary on a receipt for wages in the following two cases, paid *fortnightly*:—

Amount earned.	Total council expenditure.	Amount paid.	Workman's signature.
£ s. d.	£ s. d.	£ s. d.	
(*a*) 2 0 6	2 1 0	1 19 10	—
(*b*) 1 19 10	2 0 4	1 19 2	

In case (*a*), although the amount earned is over £2, the amount for which the workman gives a receipt is under £2. In case (*b*), although the amount earned and paid is less than £2, the actual expenditure involved is over £2. Am I correct in omitting the penny stamp in each case, because the workman does not receive his insurance stamps at the time of payment, but at the end of each half-year, when he signs a separate form of receipt? (*c*) Should a penny stamp be used in the case of a casual workman who receives his insurance stamps at the time of payment of wages, but who signs a separate form of receipt for such insurance stamps?

(*a* and *b*) In these cases we think that no stamp is necessary, as the amounts paid and in respect of which the receipts are given are each less than £2. (*c*) A penny stamp is unnecessary unless the amount is divided with intent to evade the duty.

HIGHWAY REPAIRS IN RURAL DISTRICT: LIABILITY FOR ADJUSTING MANHOLES.—"T. H." writes: Sewers have been constructed by a rural district council on their own and on county council highways, the manhole covers being placed at such levels as to satisfy the then surveyors, who have, in fact, subsequently maintained the roads for some years. After (1) ordinary highway repairs, after (2) special highway repairs (3 in. of tar-macadam, for instance), after (3) highway improvements, some of the covers are buried. Is it the duty of the sanitary or highway surveyors to raise or lower these covers as may be required for the safe user of the highway or the proper maintenance and access to the sewers? The sanitary surveyor undoubtedly remains responsible for the wear and tear of these covers, and any cost incurred is a special charge on the rural parish, whereas if a highway matter, it is a general charge on the district.

In our opinion the expenses of raising or lowering these covers are "general" expenses chargeable on the whole district. By sec. 239 of the Public Health Act, 1875, all expenses not determined by the Act or by Order of the Local Government Board to be "special" are "general." In regard to sewers, "special" expenses are limited by the section to the expenses of construction, maintenance, and cleansing, and would not therefore apparently include the expenses of the work referred to in the question.

EXTRAORDINARY TRAFFIC.—"ANXIOUS" writes: My council (rural district) have a district road which has been severely damaged by the hauling of several thousand tons of stone by a contractor to the military authorities for the building of a military camp. This contractor claims no responsibility for the damage. The last day the road was used by him was on April 14th last. I wrote to him announcing my council's intention of claiming for extraordinary traffic on October 12th. (1) Are we entitled to claim from him? (2) Is it necessary to announce our intention for so doing within six months after his using the road? (3) Could you recommend me any book on the law of extraordinary traffic, &c.?

(1) The facts as stated are very short, but the case appears to be one in which expenses are recoverable under sec. 23 of the Highways and Locomotives (Amendment) Act, 1878, as amended by sec. 12 of the Locomotives Act, 1898. Difficult questions may arise, however, in view of the fact that the contractor was acting in pursuance of a contract with the military authorities, and upon this aspect of the case it is impossible to advise here. (2) The time within which *proceedings must be commenced* (not the intention to proceed announced) is specified in sec. 12 (*b*) of the Act of 1895, and assuming that in this case the work extended over a long period, the time is six months "*after the completion of the contract or work*" (not the completion of the damage). (3) See "The Law of Extraordinary Traffic on Highways," by Barnard Lailey, K.C., or, for a shorter statement of the principles, the chapter on Highways in "Public Health Law," by Sydney G. Turner (St. Bride's Press, Ltd.), may be consulted.

DEPOSIT OF PLANS—NECESSITY FOR.—"C. W. H." writes: In one of the shipyards of my district several large extensions of workshops, offices, &c., have recently been made, and new stores, dining-room, and warehouses are in course of erection. The buildings are steel skeleton structures covered with corrugated iron, weather boarding, or concrete, and the owners declined to submit plans for the approval of the local authority. This shipyard is now a "declared controlled establishment." I shall be pleased to learn whether in your valued opinion these erections are exempt from our building by-laws, of which I forward a copy. The Public Health Amendment Act, 1907, has been adopted.

Although we know of no authority on the point, we think that these buildings are exempt from the by-laws as being "employed or intended to be employed for his Majesty's use or service" (By-law 2 (*a*)). If this opinion is not justified, see as to the application of By-law 24, the replies to "Bon-acord" in our issue of November 26th, and "Venus" in our issue of October 15th last.

REPAIR OF FENCE WALL AT SIDE OF HIGHWAY.—"Ynys" writes: A fence wall at the side of a district road, separating fields therefrom in my urban district, has subsided for a distance of about 24 ft. lineal, and I have advised my council that they are not responsible for the repairs thereof, inasmuch as the road is not affected by the subsidence in any way. The portion of the wall fallen down acts as a fence wall, and the remainder, about 1 ft. in depth below the level of the road is intact. The estate owner, however, holds that the council is liable, inasmuch as the lower portion, which is intact, holds up the highway.

In the absence of information to the contrary, we assume that the wall is the property of the owner of the field, who is presumably liable for its repair, particularly as it does not appear that the damage has been caused by any pressure of the road.

RATING OF RESERVOIR FOR SPECIAL EXPENSES.—"Hydraulics" writes: Is a reservoir constructed and used for water supply purposes, "land covered with

[illegible] for the purposes of sec. 230 of the Public Health Act 1875, and does it therefore come within the exception of certain properties from full charge to special expenses?

Yes. See *Harrow v. Urban District Council v. Southwark and Vauxhall Water Company*, 1900, A.C. 3. This case was decided on sec. 211 of the Public Health Act, 1875, the material words of which, however, are identical with those in sec. 230.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyors with a view to making the information given under this head as complete and accurate as possible.

APPLICATIONS FOR LOANS.

Cambridge T.C.—£5,350 towards the cost of the Guildhall extension.

Derby T.C.—£800 for the purchase of property for a proposed improvement scheme.

Hastings T.C.—£500 for electric house services.

Southampton T.C.—£1,300 in connection with the water undertaking.

LOANS SANCTIONED.

Bury T.C.—£980 for electricity mains.

Darlington T.C.—£15,600 for the purposes of the electricity undertaking and £7,200 in connection with the gasworks.

Dublin T.C.—£15,760 for acquiring "Fairbrothers' Field" for a housing scheme.

Goole U.D.C.—£4,100 for works of sewerage.

Islington B.C.—£5,455 for electricity mains.

Poplar B.C.—£3,688 for electricity mains.

LOANS REFUSED.

Hornsey B.C.—£5,800 for the manufacture of bituminous clinker road materials.

Swansea T.C.—£55,000 for harbour administration.

FORTHCOMING INQUIRIES.

DECEMBER.	£
14.—**Todmorden.** For works of sewerage (Mr. A. G. Drury)	200
14.—**Portland.** For works of water supply (Mr. P. M. Crosthwaite)	1,900
15.—**Kingston-upon-Thames.** For the purposes of the electricity undertaking (Mr. P. M. Crosthwaite)	16,702

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

ANNUAL GENERAL MEETING.

At the fourteenth annual general meeting of the Association of Managers of Sewage Disposal Works held yesterday afternoon at the Holborn Restaurant, London, Dr. Sidney Barwise, county medical officer of health of Derbyshire, was installed as president of that body in succession to Dr. H. Mawson Wilson, chief inspector of the West Riding Rivers Board.

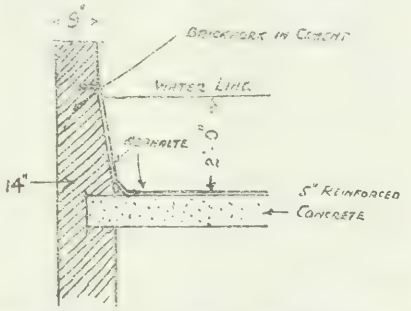
Dr. Barwise said he appreciated very greatly the honour conferred upon him by the association, and went on to express gratification that so many members, in spite of the dislocation which the war was causing, had been able to be present that day. Sewage managers were carrying on their work as usual, and he thought it would be a very bad thing for the country if that were not the case. Alluding to the work of the Germans in connection with sewage purification, Dr. Barwise observed that we had nothing to learn from them there. The conical-bottomed tank was all that stood to their credit up to the present.

Mr. C. H. Ball, the hon. treasurer, having made a short statement with regard to the finances and membership of the association, both of which are eminently satisfactory—the meeting proceeded to the consideration of a paper entitled "The Work Done at Salford by the Activated Sludge Process," by Mr. W. H. Duckworth, F.C.S., and another on "Recent Improvements in the Construction of Cultivative Tanks," by Mr. W. D. Scott-Moncrieff, M.I.MECH.E., F.R.S.I., past-president. Mr. Scott-Moncrieff's paper is reproduced on another page of this issue.

QUERIES AND REPLIES.

We cannot undertake to reply to any queries which are not accompanied by the writer's name and address. These are required as a guarantee of good faith, and not for publication. Sketches accompanying queries should be made separate, on white paper, in plain black ink lines. Lettering or figures should be bold and plain.

905. Water Tank on Roof.—"Frost" writes: I have to provide a water tank on the roof of a building, the size being 40 ft. by 36 ft., and 2 ft. deep. The bottom of the tank will be 5-in. reinforced concrete, covered with ¾-in. asphalt, and I propose to form the sides with brickwork in cement, battered



from 14 in. to 9 in., as sketch. The tank will be in a very exposed position and liable to get frozen over, and I wish to be quite certain that the expansion of the ice in frosty weather will not push over the parapet walls. Would any of your readers give me an opinion as to whether the walls as suggested would be strong enough, and, if not, what would they recommend, or to what extent should the wall be battered?

906. Drainage of Farm Buildings.—"Aqua" writes: Will any of your readers give details of septic tank and filter-bed suitable for the drainage of farm-houses and shippon to prevent pollution of reservoir? Can filtrate be turned on to land, and, if so, at what distance from reservoir? If not, how is it dealt with?

ROAD ECONOMIES IN NORFOLK.

The Eastern Highways Committee of the Norfolk County Council on Saturday adopted the report of a sub-committee on the subject of war economies in road expenditure. This stated that they (the sub-committee) had interviewed all the district surveyors and ascertained their views as to what possible saving could be effected in the maintenance of the main roads of the county for the ensuing financial year without imperilling their efficiency. In the main, the idea was that, while the more important arteries of traffic should be kept up to a pre-war standard, a considerable saving might be effected in the maintenance of the secondary roads, the purposes of which are not so important either for ordinary traffic or for war traffic. This idea seemed to the district surveyors to be practicable to a considerable extent, especially as the secondary roads are at present in a good state of repair, and, together with the main roads, have not been much affected by the weather which has up to the present prevailed. Roughly speaking, each surveyor expressed himself as able to make a saving in the direction indicated of an amount which would approximately average £500 for each district, making a total of £3,500 for the Eastern Division of the county. The sub-committee are informed that the Western highways district surveyors were of a similar opinion, and that a saving of £2,500 could be effected in the Western Division. This makes a total of £6,000, which is practically a penny rate.

It is understood that the Road Tarring Committee will recommend to the county council that no road-tarring be undertaken in the county. This was done upon the recommendation of the county surveyor, and will effect an estimated saving of £7,000. In addition, both Highways Committees have already agreed that no expenditure in improvements should be incurred, and that no allowance should be paid to urban authorities for road-watering in their areas.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Coventry T.C.—In connection with the gas undertaking, it has been decided to purchase a site in Foleshill-road for the erection of a governor station.

Dundee T.C.—The Cleansing Committee recommend the town council to purchase property in Main-street for the accommodation of the Hilltown cleansing department.

Perthshire C.C.—It is proposed by the Highland District Committee to build a new bridge at Tarvie, at an estimated cost of £325.

Ryde T.C.—The council, which some time ago concluded negotiations for the purchase of Victoria Pier, proposes to apply to the Board of Trade for a Provisional Order to transfer and vest in them the property on the conditions arranged.

St. Helens T.C.—It is proposed to build a pavilion at Eccleston Hall, at an estimated cost of £600.

HOUSING AND TOWN PLANNING.

Barking U.D.C.—The architect, Mr. C. J. Dawson, reported upon the application of the contractors for a further allowance over and above their contract price for the erection of the second block of fifteen houses in Gascoigne-road, owing to the increased price of materials in consequence of the war. The council resolved that a further and final increase of £10 per house over and above the contract price be allowed the contractors, subject to the architect being satisfied with the contractors' accounts of the increased cost incurred.

Foleshill R.D.C.—A committee have had before them plans of 600 houses which it is proposed to erect at Wyken, the dwellings to be for the use of munition makers in Coventry. As the by-laws were not complied with in regard to drainage and the width of some of the thoroughfares, the plans were referred back. The plans provide for several classes of houses.

Kingstown T.C.—A scheme has been adopted for the erection of sixty artisans' houses at Brook-lawn, and forty at Callaghan's-lane.

Leeds T.C.—The corporation have prepared another town planning scheme, affecting what is known as the Buckingham House estate at Headingley. The land covers a small estate of some 6 acres.

Ormskirk U.D.C.—It is proposed to build fifty cottages for artisans on a site in Aughton-street.

Newcastle-upon-Tyne T.C.—The council on Monday decided to accept four tenders for the erection of 336 houses, consisting of 74 two-roomed, 114 three-roomed, and 70 four-roomed flats, and 48 self-contained houses, at a total capital cost of £67,487, the necessary street and sewerage work bringing the cost up to £78,419. Towards this the Government, through the Ministry of Munitions, offer a grant of £15,120, leaving a nett capital cost of £63,299 to be borne by the corporation.

REFUSE COLLECTION AND DISPOSAL.

Bromley (Kent) R.D.C.—It has been decided to issue a leaflet stating that garden refuse must be burned and not placed in the dustbins.

Wilton T.C.—The General Purposes Committee are considering a scheme for the treatment of the town refuse.

ROADS AND MATERIALS.

Barking U.D.C.—The surveyor, Mr. C. F. Dawson, has been instructed to proceed with the continuation of St. Paul's-road by direct labour.

Battle R.D.C.—The surveyor, Mr. H. Blackman, has been instructed to report on the best means of coping with the slippery condition of certain parts of the roads.

Bromley (Kent) R.D.C.—A tender for the supply of field-picked flints to be delivered at Sandy-lane, St. Paul's Cray, was received, the price being 7s. 6d. per yard. The highway surveyor, Mr. R. Craig, said he could work some dug flints at about 3s. or 3s. 6d. per yard, and the matter was left in his hands.

Dudley T.C.—A proposal is being considered for the purchase of sites in New-street and Tower-street for the purpose of street improvements.

Dungannon U.D.C.—The council held recently a special meeting to consider the Tyrone County Council's declaration against "main roads" in the county. It was mentioned that an appeal against the decision could be made to the Local Government Board, but it was decided to take no action on the ground that if there were "main roads" the Dungannon district would have to pay for the upkeep of roads in the northern part of Tyrone which were not kept in good condition.

Flaxton R.D.C.—It was suggested by the chairman, Mr. T. Harrison, that it would be advisable to employ a machine for the purpose of distributing sand over the slippery surfaces of the roads. One man to go with the machine would succeed in covering more ground in the same space of time than could six men with horses and carts. It would also be as cheap as manual labour, and the work would be much more satisfactorily done.

Guildford R.D.C.—An intimation has been received that the War Office will be prepared to make a grant of £949 towards the cost of repairing certain roads damaged by military traffic, and that the Road Board would sanction a loan to the council, spread over three or four years, free of interest, to meet the council's share of the cost.

Hampton Wick U.D.C.—The tender of Messrs. Lavender & Bateman, of Sutton Bridge, Lincolnshire, was on Monday accepted for the supply of about 200 yds. of 1½-in. Mountsorrel granite, at 16s. 3d. per cube yard, delivered at Teddington station.

Hythe T.C.—It has been decided to repair the main road from Red Lion-square to Seabrook.

Norfolk C.C.—At a meeting of the Eastern Highways Committee on Saturday it was intimated that letters had been received from the Diss and other urban districts protesting against the committee doing away with road tarring.

Ramsgate T.C.—It has been agreed to make up St. David's-road under the Public Health Act.

Richmond (Yorks) R.D.C.—It is proposed to carry out an improvement at a dangerous corner at the top of Sleegill, at an estimated cost of £100.

St. Helens T.C.—The Highways Committee recommend the town council to accept an offer by the Sutton Manor Collieries, Limited, of £800 towards the cost of a public improvement in connection with the proposed railway across Jubit's-lane.

Saxmundham U.D.C.—The council are negotiating with the county council with a view to obtaining a grant towards the cost of making up the road from the north to the south entrance of the town.

Soke of Peterborough C.C.—It has been decided to carry out repairs on the Glinton and Northborough road.

Stockton T.C.—The borough engineer, Mr. T. P. Frank, has been instructed to prepare a scheme for a new road on the east side of Ropner Park. In conjunction with the town clerk he has also been requested to report upon a proposal for a new road from Tynedale-street to Gray's-road.

Westminster B.C.—The Works Committee recommend that repairs be carried out in a number of roads, at an estimated cost of £1,885.

Winchester T.C.—An intimation has been received from the Road Board that they have recommended the War Office to make a grant of £300 towards the widening of Bridge-street.

SEWERAGE AND SEWAGE DISPOSAL.

Braintree R.D.C.—It has been decided to carry out sewer extension works at a cost of £200.

Manchester T.C.—The Rivers Committee have approved a scheme for the provision of tanks at the Davyhulme sewage disposal works in connection with a water-condensing project for the electricity department. The estimated cost is £50,000.

Stockton R.D.C.—The sanitary surveyor, Mr. J. Rodham, has been instructed to prepare a report on the Carlton sewage disposal works, with a view to an enlargement scheme.

WATER, GAS, AND ELECTRICITY.

Amble U.D.C.—The surveyor, Mr. W. Burton, has reported to the council on a scheme promoted privately for a supply of electricity to the town.

Barnard Castle U.D.C.—A report has been submitted showing that a new scheme of water supply would involve an outlay of £10,000.

Bispham U.D.C.—The council have approved a scheme of electric lighting for the town.

Clones U.D.C.—The council are giving consideration to proposals for augmenting the water supply to meet the growing needs of the town.

Dewsbury T.C.—It has been decided to carry a 6-in. water main along Ossett-lane.

Finchley U.D.C.—It has been agreed to carry out electricity main extensions, at an estimated cost of £254.

Northwich U.D.C.—Notice has been given of a Parliamentary Bill for the purchase by the council of the undertaking of the Northwich Gas Company.

St. Austell R.D.C.—Consideration is being given to a proposal for a water supply to Penhale and district.

Tynemouth T.C.—Notice has been given that it is the intention of the corporation to promote a Parliamentary Bill for the extension of the water supply and the enlargement of the area of supply.

Wakefield T.C.—It is intended to promote a Bill in Parliament next session in connection with the water undertaking.

Wigton U.D.C.—The surveyor, Mr. J. J. Davison, has been instructed to obtain particulars as to the cost of a meter of the waste-water detecting type.

MISCELLANEOUS.

Barking U.D.C.—The acting surveyor, Mr. R. A. Lay, has been instructed to inquire the prices of the market rights in connection with the old town hall.

Essex C.C.—The council have adopted a resolution notifying all their employees of military age that the council will place no obstacle in the way of their being enrolled and attested for his Majesty's Forces, under the group system.

Hampton Wick U.D.C.—Of three tenders, that of Mr. W. Staples, of Kingston, has been accepted for four months, at 12s. 6d. per day for hire work, 2s. 7d. per yard for cartage from the wharf, and £77 for dust removal. The prices are £15 in excess of the preceding contract for dust removal, and 3s. 6d. a day more for hire work.

Sunderland T.C.—The Watch Committee have adopted a recommendation for the provision of a new fire engine and escape.

Thirsk R.D.C.—The council agreed recently to the application of the roadmen to be allowed to leave work at one o'clock on Saturdays.

Wimbledon T.C.—By way of a war bonus, the labourers engaged in making the roads and sewers in connection with the military camp on Wimbledon Common have had their wages increased from 7½d. to 8¼d. per hour.—Work costing £600 has been carried out by the corporation at the depot, Queen's-road, in connection with the 190th (Wimbledon) Brigade, R.F.A. The cost of erecting stables for the brigade was £289.

APPOINTMENTS WANTED.

CHERTSEY RURAL DISTRICT COUNCIL.

The above Council invite applications for the post of Shift Engineer at their Sewerage Pumping Station, containing suction gas plant, pumping machinery, air compressors, &c. Wages 30s. per week. Candidates must state previous experience, age, marital condition, and present occupation. Candidates must be ineligible or unfit for H.M. Forces. Applications, which must be accompanied by a copy of a recent testimonial, must reach me not later than the 1st January, 1916.

L. PORTER,
Assistant Clerk to the Council.

80 Guildford-street, Chertsey.
December 11, 1915. (2,787)

PERSONAL.

Mr. W. N. Wood, surveyor of highways to the Ticehurst Rural District Council, who has been unwell, is improving.

Mr. E. W. Edwards, surveyor to the Blaenavon Urban District Council, has had his salary increased by £30 a year.

Mr. S. W. Mobbs, assistant borough surveyor of Lowestoft, is applying for a commission in an engineering unit of the Army.

Mr. John Gordon was on Monday last appointed burgh surveyor of Aberdeen, in succession to the late Mr. William Dyack, at a salary of £450 a year.

Mr. A. Knight, assistant surveyor to the Southam District Council, has enlisted in the Royal Engineers. The council are keeping the position open for him to return to.

Mr. A. Murray-Smith, ASSOC.M.INST.C.E., of the borough engineer's office, Cheltenham, has been granted a commission in the Hampshire (Fortress) Royal Engineers.

Mr. R. Mitchell and Mr. Samuel Chisholm, members of the corporation sanitary staff, have been appointed chief assistant sanitary inspectors of Dundee, at a salary of £150 each.

Mr. R. E. Ford has been appointed acting borough surveyor and water engineer of Doncaster during the absence of the borough surveyor, Mr. F. O. Kirby, on active service with the Royal Engineers.

Mr. D. J. Bowe, surveyor to the Clacton Urban District Council, has been voted £100, payable in two instalments, in recognition of his extra work in connection with the building of the band pavilion.

Mr. V. S. Wells having resigned his position as chief of the fire brigade of the Merton and Morden Urban District Council, it was decided on Friday to invite applications for the vacancy, at a salary of £100, rising by annual increments of £10 to £140.

Mr. William Welburn, borough surveyor of Middleton, who has retired, we regret to state, owing to failing health, has been appointed consulting surveyor to the corporation, at a salary of £150 a year, to date from December 1st. The assistant surveyor, Mr. Clegg, will take charge of the borough surveyor's department until after the war.

Captain J. Fred. Hawkins, R.E., the Berkshire county surveyor, who was requisitioned for special work on the staff of General Gibbon, chief engineer to the Eighth Army Corps at the Dardanelles, has been dangerously ill. An operation for an acute appendix abscess was performed on board a hospital ship on October 7th, and for the past seven weeks he has been in hospital at Alexandria. In a letter from Alexandria, dated November 24th, Captain Hawkins says he expects to leave for home on the next hospital ship.

In our issue of November 26th we announced that Mr. Robert H. Bicknell, M.INST.C.E., had retired from the position of engineering inspector under the Local Government Board. We now hear that, despite the present bad times, Mr. Bicknell has decided to join the ranks of the Westminster consulting engineers, and has taken offices at 16 Victoria-street, S.W. Mr. Bicknell is known as a thoroughly practical man by early training in the shops, his long and varied experience in charge of important public works at home and abroad, and his twenty years' service as engineering inspector would appear to make him eminently fitted to advise on engineering schemes, or to act as arbitrator or expert witness.

OBITUARY.

Mr. James Newman, for many years surveyor to the Sandown Urban District Council, died recently at Shanklin.

Lieutenant Stanley Vanstone, of the Rifle Brigade, late assistant surveyor to the Teignmouth Urban District Council, has, we regret to state, died from wounds in France.

A Proposed Manchester Loan Refused.—The Local Government Board have informed the Manchester Corporation Rivers Committee that they cannot entertain at present the application for sanction to borrow £3,250 for the construction of a storm-water sewer in College-road, Whalley Range.

Benefits Derived by an Urban District Adopting a Town Planning Scheme.*

By W. LOUIS CARR, Surveyor to the Ruislip-Northwood Urban District Council.

The town planning scheme promoted by the Ruislip-Northwood Urban District Council received the approval of Parliament on September 7, 1914, and as the period of twelve months, during which all claims for compensation and betterment have to be lodged, has now elapsed, the author is able to state generally the benefits which have been secured to the public and the landowners, and to give some information as to the claims for compensation and betterment, which latter subjects have seriously engaged the attention of councillors and officials throughout the country.

The modifications of the "General Provisions" are not dealt with in this paper, but it will be of interest to describe the alterations in the draft scheme as shown on the 25-in. ordnance map, which may be summed up as follows:

STREETS AND FOOTWAYS.

The north end of a 60-ft. street, practically running north and south through the centre of the district, has been amended to obtain a better outlet across some golf links. In the original scheme a road was proposed across these golf links, but, owing to heavy opposition, the council decided to drop it; the Local Government Board have, however, reverted to the original scheme. Another alteration was with regard to a new road branching from an existing road which was shown to run over existing buildings. This was amended so as to avoid pulling down the buildings. A further alteration was a very interesting one. An alternative line of route was shown for a new 60-ft. road, but the Local Government Board decided that alternatives could not be shown, and a definite line had to be fixed. In another case two streets were indicated on the map by dotted lines, together with a single alternative road. The board decided that the single alternative road had to be omitted. In the case of a new road, which was shown as 40 ft., but had to be increased to 50 ft., the centre line had to remain as shown on the map. A number of new footways were amended as regards their width and position, and two footways which had been shown to be diverted were omitted.

APPROPRIATION OF LANDS.

One cemetery, allotments, land for store yards, and a refuse destructor, together with certain open spaces, were acquired under the Public Health Acts during the progress of the scheme, and could not therefore be included in the approved scheme. With regard to the suggested second cemetery in the south of the district, the board considered that the time was not ripe for another cemetery to be provided in this quarter, but my own opinion is that a mistake was made in not allowing us to acquire this land, as later on, in all probability, we shall have much difficulty in securing such a suitable site as the one scheduled.

The owner of the land originally selected for the purpose of a new sewage works objected strongly to the position, but willingly gave us the option of another site about ¾ mile away. Unquestionably this will be a great advantage to the district, and it will enable a greater area of land to be satisfactorily developed without any nuisance being caused when the new sewage works are made.

Differential treatment was proposed for railway land, but after negotiations with the companies we were able to come to agreement with regard to all their various parcels of land in the district, which are now to be treated in the same way as the property of any other landowner.

BUILDING LINES.

The building lines shown on existing streets have been approved, except in one case, where it was reduced from 25 ft. to 15 ft. The reason for this alteration was that the ground receded very quickly from the roadway, and serious difficulties would have arisen with regard to connection with sewers, aspect, &c. It would be advisable here to observe that in future schemes, if building lines are reduced under similar circumstances on one side of the street, arrangements should be made to set them back on the other side.

LIMITATION OF THE NUMBER OF BUILDINGS TO THE ACRE.

The first alteration was the inclusion of a further area of land to carry from eight to twelve buildings to the acre, the reason being that this area lent itself to more equitable development than the land unit which had been fixed. A further alteration enables us to secure in the future a more gradual form of development. Another small portion was scheduled under the draft scheme as six buildings to the acre, but after the inquiry, at which the owner put a number of facts before the inspector, this limitation was altered by agreement between the council and the owner, with the result that approximately ten buildings to the acre can be erected. As the result of opposition, the Local Government Board agreed to a certain area being scheduled at eight houses to the acre instead of six as provided in the draft scheme.

CHARACTER OF BUILDINGS, ETC.

As a result of the inquiry, certain alterations were made in the compulsory and optional shopping and factory areas.

With regard to the colouring of the final map it should be pointed out that after the inquiry it was found necessary to amend the whole of the colouring to fit in with the new "reference" which was required. The Ruislip-Northwood Urban District Council and the Watford Rural District Council have to administer this scheme in their respective areas, and a copy of the map of the final scheme, so far as it relates to the part of the area in the Watford rural district, has to be provided by the council.

NEW STREETS.

There are some eighty-three new streets and footways to be constructed under the scheme, *and in the lines and of the width indicated on the map.* The words italicised require special notice, as the Local Government Board are insistent upon this being carefully considered when the scheme is prepared, and strictly adhered to afterwards. The district will benefit greatly in future by the linking up of existing streets and main traffic routes, and also by the improved access to railway stations, and the bringing of certain outlying areas into communication with others by streets with good gradients, instead of by streets which would have a gradient of 1 in 7. For instance, when one of the streets is made a distance of about 3 miles will be saved in communication between certain parts of the district.

Another great benefit, combined with economy, will be derived by the laying out of the streets on the line of the outfall sewers to the existing and new sewage works. Arrangements have also been made to take the house drainage from these new streets. A certain amount of the cost of these sewers will be defrayed by the frontagers, but such sum is not payable until the land is used for purpose other than agriculture, except by special agreement. In my opinion many thousands of pounds will be saved to the district by thus laying out the streets to serve all purposes for which streets are generally required.

Streets shown on the map of a greater width than 40 ft. will be constructed and paid for by the council, but it is possible, as the council now have the power to make up streets with grass margins, &c., that no extra expenditure will be incurred beyond that of scavenging and maintenance. Thirty widenings of existing streets are shown on the map; these are in sixteen streets, and affect forty-four different owners.

When any plan is submitted for a new building to be erected in any of the existing streets, the council can require the street to be widened to the width shown on the map, and will bear the cost. If the council require a street to be widened before any plan for a new building is submitted, they have power to do the work after giving two months' notice. The cost of carrying out widenings in such case will include compensation for any buildings required to be altered, demolished or removed, while the construction of the necessary carriage and foot-

* Paper read at the recent annual meeting of the Institution of Municipal Engineers.

[redacted] and [redacted] of the land has also to be paid by the council.

[redacted] the council have power [redacted] to plant with trees, [redacted] any part of any street [redacted] the [redacted] and the council [redacted] and [redacted] They may [redacted] grass margins, whether planted with trees or laid out as gardens, and may from time to time alter or [redacted] any street laid out as a carriageway or footway respectively, provided that the council shall not obstruct access to premises abutting on any street from the metalled or paved [redacted]

[redacted] upon any new street shall, until such street shall become a highway repairable by the inhabitants at large, maintain such [redacted] and embankments and other works therein in good order and condition. The council may include in any private street works any works which they may consider necessary for fencing off and laying out any street, [redacted] and providing the same with trees, and apportion the expenses thereof as would be done under the Private Street Works Act. The permission given to the council under this Act to lay out existing streets or any new streets with grass margins, &c., is very important, and, besides leading to much amenity in the district, will also involve less expense in construction and [redacted] by taken over by the local authority, a reduced expenditure has to be borne by the frontagers.

In shopping areas where a carriage road is intended to form the principal approach or means of access to buildings, we demand that the kerb or outer edge of the footway of the street in front of such buildings shall be set back a width of 6 ft. from the side of the carriageway, and the width of the footway shall be reduced accordingly. The intervening space between the new line of the kerb and the original side of the carriageway shall be so constructed as to fall towards the carriageway. This requirement is believed to be quite new, and should prove of great value, as by means of it tradesmen's goods can be delivered by vehicles standing on this set-back, where they will not impede the fast traffic.

Particulars of the relaxation of by-laws with respect of (1) new streets (short streets), (2) as to width and construction of such streets, where land for open spaces is set apart, or wide streets are provided, or where the streets are formed around quadrangles, are all set out in the "General Provisions"; but it may be said that with the experience already gained in the district from the construction of streets of this character, the council and the owners are satisfied that they are not only unlikely to be a burden on the ratepayers, but are more economical to construct, sewer, light and scavenge.

If at any time the council desire to construct any of the new streets on the map, they can do so upon giving six months' notice of their intention. Without this provision it is probable that the whole scheme of the streets shown would be wrecked. Where the map shows a new street exceeding 40 ft. in width, communicating at each end with a highway repairable by the inhabitants at large, the owner of the land over which it passes may, if he wishes it to be constructed, give notice to the council, who must construct the road within six months. Before the development of any estate can now be proceeded with the council can require the owner to furnish plans and particulars showing generally a scheme for the development or laying out of the whole of such estate or such part thereof as the council may reasonably require.

All streets constructed otherwise than by the council shall be constructed with such turning and crossing places, and on such sites as shall be required by the council. It will be seen, therefore, that development cannot take place until an owner has first received the approval of the council to his scheme.

The Local Government Board may, on the application of the council or owners, sanction any modification *in detail* with reference to the position or construction of any of the proposed new streets or proposed widenings shown on the map. In the author's opinion sufficient latitude is not given to modify the [redacted] of the streets marked on the map. In several cases no harm would have accrued by fixing a limit of deviation between certain points (on one owner's land, of course) of, say, 40 ft. to 60 ft., as in the case of projected railways.

Under this scheme twenty-one highways are to be diverted and stopped up, but not until certain new streets or footways have been constructed to the satisfaction of the council and opened up for public traffic. Where [redacted] such proposed new [redacted] are constructed in portions, such portions of the public highways as correspond to the portions of the said new streets which have been made may be diverted or stopped up, provided the council are reasonably satisfied that an equally convenient right of way has been provided for the public use; and where necessary a temporary right of way must be constructed from the portion of the proposed new street which shall have been constructed to that portion of the said public highway which is not, at that time, to be diverted or stopped up. For the purpose of any further diversion or stopping up, such temporary right of way shall be deemed to be part of the remaining portion of the said public highway. It is estimated that by these diversions a saving of some hundreds of pounds has been effected by avoiding the lengthy and technical process of obtaining an Order of Quarter Sessions, apart from the difficulty in some cases of strictly complying with the requirements of the Highway Act, 1835.

OPEN SPACES.

There are about 155 acres of open spaces shown on the map, of which 106 acres have been acquired under agreements, and 49 acres are scheduled as public open spaces. The estimated value of the land given to the council is from £8,000 to £10,000. Private open spaces shall be maintained in good order, and, when required by the council, shall be fenced by and at the expense of the owner. If at any time a private open space, or the fencing, becomes neg[redacted] the council may, after giving not less than fourteen days' notice of their intention, execute any works for the purpose of maintaining the same in good order and properly fenced. Any expenses incurred by the council are recoverable from the owner of such private open spaces.

When any private open space is conveyed to the council without payment, they may, subject to any conditions under which the land is acquired, make special regulations with reference to any matter affecting its use, and may demand rent or other charges for its use. This power of controlling private open spaces is very useful, as under its provisions the area can never be built on, and an amenity is secured not only to the houses in the immediate neighbourhood, but to the district as a [redacted] A few valuable private open [redacted] are shown on the map, and many more will probably be added as the scheme develops. The Charity Commissioners' lands have been secured as private open [redacted]

Compensation may be claimed for the foregoing items, but it will be well now to consider the benefits which have been secured by our Act without the [redacted] of subsequent compensation.

SPACES ABOUT BUILDINGS, INCLUDING BUILDING LINES.

The building lines shown upon the map along existing streets averaged a 25-ft. set-back, and excepting in one small instance they have been allowed. It is provided that if any building has been erected, or is in course of erection, since the date of the resolution of the council applying to the board for authority to prepare the scheme, nearer to a street than the building line shown on the map, the council may require the owner to pull down so much of the building as is nearer to the street than the said building line. In one case a building line of 7 ft. was shown, but an owner built in front of this very reasonable line, with the result that he will now have to pull down where he has infringed.

In streets where no building lines are shown on the map no buildings can be erected nearer to the centre of the street than 30 ft., or nearer to the boundary of such street than 15 ft. Provisions are inserted with regard to dwellings round quadrangles, but in any case there has to be a width of 60 ft. between every house. There are also saving clauses with regard to lodges appurtenant to a dwelling-house which may be built in advance of the building line, and also in the case of long frontages, say a continual frontage of not less than 300 ft., where parts of such building may project 7 ft. in advance of the general building line, provided the projection

does not exceed one-fourth of the total length of the frontage. The above building lines do not prevail in the case of shopping and business premises, the lines for which are practically set out in the "General Provisions," and vary according to the different widths of the streets. This is another means by which to secure the extra width of the carriageway to business premises.

Another important provision is that no post, rail, or other obstruction shall be erected in front of the forecourt of any shopping premises; but cellar-flaps are allowed, provided they do not project more than 3 ft. in advance of such premises. The building lines for buildings and projections on corner sites are specially provided for. Bay windows, chimneys and porticoes are allowed to project 4 ft. in advance of the building line, except in the case of a street exceeding 40 ft., when they may project 5 ft., provided that these projections do not exceed three-fifths of the total width of the buildings, and are not in any case nearer to the boundary of lands belonging to another owner than the extreme amount of such projections.

The proportion of the area of a site which may be covered by shops and other buildings is one half of the whole area of the curtilage, with the proviso that in the case of a shop the extent of the buildings shall be measured at a level of 14 ft. above the mean level of the footway in front thereof. This appears to be a reasonable provision. With regard to dwelling-houses, one-third of the whole area may be covered with buildings not exceeding one storey in height and one storey in the roof; but in cases of larger buildings the area covered shall not exceed one-fourth.

Certain provisions are made with regard to air-space to habitable rooms. This is a most important provision, as, to a certain extent, it stops the erection of houses with kitchens facing each other at a distance of, say, 2 ft. or 3 ft. away, which are practically always dark and have bad ventilation. The clause with regard to the projection of wing buildings is another important one, the idea being to stop the addition at the rear of premises of long wing buildings, which retard the free action of the air and sunlight to the back of the premises.

LIMITATION OF NUMBER OF BUILDINGS TO THE ACRE.

In the clauses which have been framed to carry out the limitation of the number of buildings, regard has been had to the various areas in the district, the development of which have been commenced in a certain way. A limitation of four buildings to the acre is made for the highly residential part; six to the acre is the rate for the areas at present developing; eight and twelve to the acre is also adopted in other areas for the same reason; while twelve is also adopted for the shopping and factory areas, where it is desirable that more buildings to the acre should be allowed both to secure artisan and working class buildings near the places of employment, and also because by reason of the shops and business premises it would not pay to erect better-class houses.

The unit of 5 acres has been considerably discussed, but the author cannot suggest any other scheme to carry out the limitation in a more satisfactory manner. The working of this land unit is not easy, and possibly about 9 acres would be a good unit to adopt. In all areas, with the exception of land specially set apart for factories, shops and business premises, private or professional dwelling-houses, with necessary stabling, &c., can alone be erected.

No domestic building (other than flats or sets of chambers) erected in the area of twelve buildings to the acre, may contain more than two storeys, exclusive of any storey in the roof.

CHARACTER OF BUILDINGS.

In selecting the areas to be restricted to buildings of the warehouse class, shops, or business premises, consideration was given to the lay of the land, the position of the railway stations, the convenience of access, and the amenity of the district. The area for factory purposes has been extended in the vicinity of the existing sewage works.

The clause relating to the height of windows in habitable rooms received considerable attention, not only by the council, but also by landowners, builders, &c., and the final form represents the utmost advance that could be made; but we believe it will be of considerable value generally to the health of the district. This provided that no bedroom or other habitable room shall contain less than 500 cub. ft., and in any dwelling one living-room at least shall be provided, which must have a floor area of not less than 144 sq. ft., and contain not less than 1,132 cub. ft., and one bedroom which must have a floor area of not less than 132 sq. ft., and a cubical capacity of 1,000 cub. ft. It is hoped that considerable good will emanate from the provision which enables the council to require reasonable alterations in any building, the character of which is objectionable on account of the design, or the undue repetition of the design, or the materials to be used.

SANITARY CONDITIONS AND AMENITY.

With regard to the vexed question of combined drains, a clause has been secured which it is hoped will solve the problem. Every house has under this scheme to be provided with a pantry or larder which shall have a window opening into the external air, and in the case of a dwelling-house adapted to the occupation of more than one family, a separate pantry or larder shall be required for each. It is also provided that every domestic building constructed for use of more than one family shall be provided with separate closet accommodation for each family. To some extent these clauses will prevent houses being let for two families without proper accommodation being provided. Further provisions are desirable, but their inclusion could not be obtained.

Frequently private gardens are in such a state as to be a nuisance to neighbours, but under the Order, on the report of the surveyor that the nuisance can be abated, the council may do what is necessary in default of the owner doing it, and can recover the cost. In the Ruislip-Northwood urban district, in common with many others, a great deal of untidiness and irregularity occurs in planting and fencing of forecourts of premises, which detracts from the general appearance of the district. To remedy this the council have power to agree with the owners or occupiers to lay out, plant and fence such forecourts and maintain them at the expense of the council.

Advertisements are prohibited, except in the factory and shopping areas; but this prohibition does not apply to the exhibition of traders' names or notices on public buildings. Goods for sale or exhibition may be placed in front of premises, but not more than 3 ft. beyond the building line. This is a most useful provision, and will be of much assistance to the council in keeping the streets from looking untidy and irregular. Considerable criticism has been made of the clause dealing with the height of fences, but it can still be said that the council are glad to have got this clause, and they have not the slightest difficulty in carrying it out. It is beneficial to the district to obtain solid walls or fences set back as far as possible from the back line of any street.

A careful consideration of all the clauses, which are set out in more detail in the "General Provisions," should prove a great stimulus to local authorities to promote a town planning scheme for the benefit of their community, for it is unquestionably a fact that the health, welfare and general tone of a district would be greatly enhanced by similar provisions to those included in the Ruislip-Northwood Town Planning Order.

COMPENSATION AND BETTERMENT.

Only four claims for compensation have been received, and two of these have practically been disposed of. As to betterment, thirteen claims have been made, totalling some £11,000. The cost of preparing the scheme, from start to finish, was about £700. A statement of expenditure was given at the inquiry on the draft scheme, regarding the purchase of land for open spaces, cemetery, allotments, recreation ground, and destructor; but these items were struck out as they had been acquired under the various Public Health Acts during the progress of the scheme. The proposed expenditure on another cemetery site at Ruislip was dropped after the inquiry. The estimated expenditure for the demolition or alteration of buildings, for compensation in regard to property injuriously affected by the scheme, for roads abutting on open spaces, for making up or alteration to roads or footways, and widenings, and for other purposes, such as fencing of open spaces, &c., remains about the same now the scheme has been approved. The greater part of this expenditure, however, is not likely to be incurred for many years. The receipts estimated to be obtained from betterment claims are largely increased from what was originally anticipated.

DISCUSSION OF MR. CARR'S PAPER.

Mr. W. Matthews Jones (Chester), in proposing a vote of thanks to Mr. Carr for his paper, asked who, in the setting out of the roads shown on the map exhibited, had the power of settling the line on which the roads should be laid—the surveyor or the council; also how many years had he been engaged on the scheme, and how long did it take to go through the Local Government Board. He wished to know also the area dealt with and the number of houses in the area, because, looking at the map, [illegible] Had Mr. Carr got any closely built areas in the scheme? If so, had he interfered with new roads, or cut through them? If so, had compensation been paid? He noticed they had to put a road through the golf links. Did the council have to pay compensation to the golf links people, or provide them with fresh links elsewhere? In a scheme of that sort he should like to know whether town-planning was not likely to drive all building operations out of the area into outlying areas where no town planning had been proposed, because it seemed to him as if some of the restrictions were rather severe. If he were a builder he would go where he could get the best terms. Had many houses been erected since the council served the notice that they were going to town-plan the area? He did not know whether they had gone outside the council's area, but he should like to know whether Mr. Carr agreed that in tackling a big scheme like that they should also tackle the outside areas in order to force them to come into the scheme. There were three railway companies; were there any restrictions over these? Suppose the three companies amalgamated and decided to bring a line of railway through a certain part of the area, it might upset the scheme. As to the destructor, what were they going to do if they were served with an injunction to abate the nuisance from the fumes which found their way into the adjoining district? One of the provisions of the scheme was that no post, rail, or other obstruction must be erected in front of the forecourt of any shopping premises. Would Mr. Carr allow a barber's pole or shop sign to be put up?

Mr. E. Whitwell (Abersychan) asked who settled the matter in cases where owners did not agree with the amount offered by the council for land required in connection with the widening of streets. Then, with regard to the maintenance of grass margins, would that be charged to the particular highway, and had Mr. Carr had any experience in the maintenance of these margins? Also, how would the side pieces of roadway in shopping areas be constructed, and would there be any limit to the weight of vehicles. The author mentioned that where estate owners proposed to erect houses an estate plan could be demanded. But difficulties might arise unless there were special provisions in the Act—for instance, a small piece of ground might be sold, and a new owner appeared on the scene. What control were they going to have over that? As to the matter of back additions, he personally knew of buildings which were only 10 ft. away from one another, which was unsatisfactory from the point of view of light and air. In regard to the limit of twelve houses to the acre, would it be possible for a building owner to put that number of houses together in one block, and so perpetuate the present system? There was a minimum of 500 cub. ft. of air space for bedrooms, but that appeared to be rather small. He would like to know which was the particular clause in the Act that solved the vexed question of "drain or sewer." On the question of gardens, might he ask whether, if a tenant or owner, while not having his [illegible] in a condition similar to that of waste land, it would not be a delicate matter for the surveyor to decide that it was a nuisance and serve him with a notice to remedy it? Mr. Carr had given the cost of preparing the Ruislip-Northwood scheme as £700, and it would be interesting to know whether, in the event of his having to do the work over again, it would cost him as much, for many councils would be appalled at the idea of having to spend such a sum. He thought it would be folly to place the refuse destructor so far from the centre of the town, because the question of haulage [illegible] Finally, what rate of development was now taking place in the Ruislip-Northwood area?

The vote of thanks was passed.

Mr. Carr was unable, owing to the lateness of the hour, to deal with the points raised by the speakers, but he has since prepared the following reply:

In reply to the questions of Mr. Matthew Jones, of Chester—(1) The various new roads on the town plan were in the first instance laid down by me in consultation with various surveyors representing owners of land, and no councillors interfered too much with my schemes. They certainly were consulted from time to time at all the various committee meetings, and we all worked most amicably together. The authority to prepare the scheme was given on January 16, 1911, and the approval was received to the scheme on September 7, 1914; but with regard to other schemes the town planning regulations have been greatly modified, and I should think, speaking generally, that a scheme could be got through in twelve months.

The area of the scheme is about 6,000 acres, and the number of houses in it approximately about 300. An average of 108 houses and shops per annum, for the past eleven years, have been erected in the whole of the council's area, and the average has been kept up. I can confidently say that the town planning scheme did not, and is not now, restricting building operations, as builders now know exactly what they can do, and are in a position to sell any properties that they erect, well knowing that town planning restrictions cannot be over-ridden.

We do not take in any closely built areas, but new roads have been laid to connect up to the existing streets in these areas, and, in my opinion, it is one of the great faults of the Act that closely built areas cannot be included in a town planning scheme.

With regard to the road finally laid down across the golf club, a special agreement was entered into that, as long as the golf club was used as a golf club no further action could be taken, but in the event of the golf land being developed for any other purpose the position of this road shall be maintained.

Builders are not building outside rather than inside our town planning area.

There is no reason why small detached areas should not be town planned by themselves, and, in fact, this is what I am doing in my second town planning scheme.

With regard to including outside areas in our scheme, we considered at least a radius of a mile completely round ours, with the result that we obtained permission to town plan about 60 acres in the Watford rural district, which was sufficient for our purposes in this case, as we had very good reasons for not extending any further. We got the Pinner Rural and the Harrow Urban District Councils to commence town planning in their areas, and as regards the remaining council—namely, the Uxbridge Rural District Council, we had no necessity to go very far into their district, although we have in our second scheme taken in a certain portion, owing to the configuration of the land, which fell entirely away from our district.

No railway companies can lay down any railways in our district without, of course, taking the usual procedure of promoting a Bill, and if their lines interfered in any way with our scheme we should be an opposing party in the usual way, and Parliament would decide at the inquiry what should be done; but I have no fears, even if a railway was constructed, that the scheme in any way would be wrecked.

The proposed site of the refuse destructor has a sewage works adjoining, belonging to Pinner Rural District Council. The site could not be obtained in the more popular part of the district.

With regard to "nuisances in gardens," I would refer you to Clause 60 of the "General Provisions," and I can only say that we feel this clause will be of great assistance to us.

With regard to posts and rails, barbers' poles, signs, &c., Clauses 40b and 63 are ample replies to this question. Steps to buildings cannot commence beyond the back line of the street, whatever width the street is laid out.

With regard to Mr. Whitwell's questions, the land shown for widenings has been given to the council, and no compensation has been claimed; the only cost now to the council is the cost and expense of the carrying out of such widenings, including the construction of the carriageway and footway, and the fencing of the land from the road.

All the clauses in the "General Provisions" up to No. 36 can be referred to arbitration. We cannot restrict a man building twelve houses to the acre, but if Mr. Whitwell will work out a case, and take into consideration Clause 46, he will find that the builder cannot crowd very much, and also that it would not pay him to develop his land indiscriminately with, say, a block of twelve houses, and leave the remainder to waste. In actual practice this

would not work, and I am quite certain that builders and developers prefer proper development to crowding a few houses and leaving the remainder to waste. A man cannot sell an odd plot here and there to various owners until he has deposited his scheme and received our approval; but assuming that he does without our knowledge, it must be remembered that this scheme is an Act of Parliament, and this man must give notice to any purchaser that he is selling this land under a town planning scheme, and the purchaser who buys buys in accordance with the provisions of the scheme, and he will be entitled to recover damages from such owner if, when he wishes to develop, he finds he cannot comply with our provisions.

With regard to grass margins in private streets, the upkeep is carried out by either the developer, in the first place, or, at a later stage, by the frontagers, and the council are entitled to keep a private street with or without grass margins at the expense of the frontagers. In our district we have no difficulty whatever with regard to grass margins, and we see no difficulty in enhancing the amenity of the district by allowing such relaxations as these.

The set-backs for tradesmen's carts, &c., in front of shop premises will have to be made up in all probability with setts, and this charge can be apportioned when the street is made up under the Private Streets Works or Public Health Acts.

With regard to back additions, Clauses Nos. 47 and 48 stop these long, ugly and unhealthy erections.

With regard to the provision of 500 cub. ft. for a bedroom, this clause is for the purpose of not allowing any bedroom or habitable room to be constructed with less than this cubical capacity, for a dwelling-house has to be provided with at least one living-room and one bedroom. Particulars as to size and cubical contents are given in Clause 55.

With regard to the vexed question of combined drains, the whole of Clause 57 covers this matter. The same remarks with regard to nuisances in gardens that I made to Mr. Matthews Jones applies equall to Mr. Whitwell.

The cost of the scheme (£700) undoubtedly in any future scheme could be greatly reduced; but when you consider that the council each year only allow a 1d. rate for town planning, and kept within this estimate, not much grumbling could take place.

The following is a summary of the expenses, which I trust will be useful to all the members:—

	£	s.	d.
1. Ordnance maps	82	2	8
2. Drawing materials and stationery ...	42	3	7
3. Printing schemes	45	19	0
4. Notices	30	19	2
5. Refreshments	45	16	7
6. Advertising	19	0	11
7. Inquiries	64	15	5
8. Consulting engineer	21	7	6
9. Extra remuneration and assistance	266	18	6
10. Legal expenses	90	15	2
11. Postages and sundries	51	12	1
	755	10	7
From which should be deducted the amount already received from sale of sheets, maps, drawings, &c.	57	15	9
	£697	14	10

The items Nos. 1, 3, 4, 5 and 11 will be items which could be reduced in any future scheme.

The remarks regarding the dust destructor site that I made to Mr. Matthews Jones apply to Mr. Whitwell. All land to streets of a greater width than 40 ft. is given free to the council by the landowner, and he is entitled in calculating this extra width as being set apart as an open space under the provisions of Clause 13 but only for the extra width above 50 ft.

Institution of Civil Engineers.—On the conclusion of the business of the ordinary meeting of the Institution of Civil Engineers to be held on Tuesday next, a special general meeting of corporate members will be held for the purpose of confirming resolutions adopted at the meeting on November 30th.

Engineering Colleges and the War.—A paper on this subject will be read before the Institution of Mechanical Engineers on Thursday next by Messrs. R. Mullineux Walmsley, D.Sc., F.R.S.E., principal, and C. E. Larard, head of the engineering department of the Northampton Polytechnic Institute, London. The chair will be taken at 6 p.m.

SOCIETY OF ENGINEERS.

ANNUAL GENERAL MEETING.

The sixth annual general meeting of the Society of Engineers will be held at 17 Victoria-street, Westminster, on Monday next, at 5.30 p.m., to consider and if necessary take action with reference to the following business:—

Announcement of the result of the postal ballot for the election of council and officers for the year 1916.

Announcement of the awards of premiums made in respect of papers published in the *Journal* during 1915.

Report of the council for 1915.

Election of auditors for the year 1916.

A. S. E. Ackermann,
Secretary.

INSTITUTION OF WATER ENGINEERS.

The twentieth annual winter meeting will be held at the Geological Society's apartments, Burlington House, W., to-day (Friday), commencing at 2.30 p.m. A discussion will be invited on "The Necessity for Defining the Term 'Domestic Purposes' in General and Private Water Acts."

The election of the president and council for the year 1916-17, also the election of the auditors for the year 1916 will take place at this meeting.

Percy Griffith,
Secretary.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

BOROUGH SURVEYOR AND ENGINEER. December 11th.—Corporation of Hertford. £350 per annum.—Town Clerk, The Castle, Hertford.

BOROUGH SURVEYOR.—December 13th.—Stratford-upon-Avon Corporation. £275 per annum.—Mr. R. Lunn, town clerk.

INSPECTOR OF MAINS.—December 13th.—Sleaford Rural District Council.—Mr. W. B. Marsden, engineer, Northgate, Sleaford.

TEMPORARY ENGINEER AND SURVEYOR.—December 14th.—Portland Urban District Council.—Mr. R. A. Colenutt, clerk, Council Offices, New-road, Portland.

INSPECTOR OF NUISANCES.—December 24th.—Corporation of Stafford. £150—£180.—Mr. R. Battle, town clerk, Borough Hall, Stafford.

ASSISTANT ENGINEERS.—April 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

SURVEYOR'S CLERK.—Wilton Rural District Council.—Mr. R. A. Skelton, district surveyor, Bemerton, Salisbury.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

DUNFERMLINE.—December 13th.—For the carpenter and joiner work in connection with the erection of a school, for the Dunfermline School Board.—Mr. D. Gorrie, clerk, 104 High-street, Dunfermline.

SLIGO.—December 14th.—For the erection of a pavilion, construction of water supply and sewage works, and other works, for the county council.—Mr. M. Keane, secretary, Court-house, Sligo.

BRADFORD.—December 15th.—For the execution of repairs to buildings, for the Commissioners of Works and Public Buildings.—The Secretary, Storey's-gate, London, S.W.

ALDERSHOT.—For the erection of a dwarf wall and oak fence, for the urban district council. The Surveyor.

Engineering: Iron and Steel.

LEICESTER.—December 11th.—For the supply of cast-iron pipes and connections, for the Gas Committee.—Mr. H. Pooley, engineer and manager, Gas Offices, Milton-lane, Leicester.

TEWKESBURY.—December 13th.—For the supply of a 6-in. iron ventilating shaft, for the corporation.—Mr. W. Ridler, borough surveyor.

BASFORD.—December 14th.—For alterations to bottoms of existing tanks, constructing an additional detritus tank, and sundry other works, for the rural district council.—Messrs. Elliott & Brown, engineers, Burton-buildings, Parliament-street, Nottingham.

WALTHAMSTOW.—December 15th.—For the supply of low-tension cable, for the urban district council.—Mr. G. R. Spurr, electrical and tramway engineer, Electricity Works, Priory-avenue, Walthamstow.

MANCHESTER.—December 15th.—For providing and fixing low-pressure heating apparatus, for the Education Committee.—Education Offices, Deansgate, Manchester.

ATHENS.—December 17th—30th.—For the maintenance and working of the undertakings necessary for the water supply, and laying a distributing system.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

WARRINGTON.—December 18th.—For mechanical tipping apparatus for coal wagons, for the corporation.—Mr. W. S. Haddock, general manager, Gas Offices, Warrington.

CHORLEY.—December 18th.—For the supply of galvanised steel ashbins, for the corporation.—The Sanitary Inspector, Back-street, Chorley.

SOWERBY BRIDGE.—December 18th.—For the supply of 145 yds. of wrought-iron and steel fencing and gates, for the corporation.—Mr. W. S. Haddock, general manager Gas Offices, Warrington.

JOHANNESBURG.—December 30th.—For the supply and erection of ice-making and refrigerating plant, for the municipal council. — Intelligence Branch of the Board of Trade, 73 Basinghall-street London, E.C.

VICTORIA (Australia).—January 12th.—For the supply of steel rails and fishplates, for the Agent-General for Victoria.—Messrs. John Coates & Co., 115 Victoria-street, London, S.W.

Roads.

CAMBRIDGE.—December 11th.—For the supply of broken granite, syenite, and basalt, or similar stone, for the corporation.—Borough Surveyor, Guildhall.

DUDLEY.—December 13th.—For the construction of about 1,570 lin. yds. of new main roads, and about 600 lin. yds. of communication roads, with manholes and sewer ventilators, for the corporation.—Borough Surveyor, Town Hall.

WANDSWORTH.—December 13th.—Tenders are invited for the purchase of a 10-ton Aveling & Porter steam road roller.—Mr. P. Dodd, borough engineer and surveyor, 215 Balham High-road, London, S.W.

HORSHAM.—December 13th.—For the supply of 25,000 gallons of tar, for the rural district council.—Mr. W. Dengate, surveyor, 58 Park-street, Horsham.

REIGATE.—December 14th.—For the supply of from 1,000 to 2,000 tons of granite macadam, for the corporation.—Mr. Fred T. Clayton, borough surveyor, Municipal Buildings, Reigate.

SALFORD.—December 14th.—For works of paving, for the corporation.—Borough Engineer, Town Hall.

WILTS.—December 15th.—For the supply of granites, basalts, limestones, chippings, tools, implements, Tarvia spraying, and steam rolling, for the county council.—Mr. J. George Powell, county surveyor, Trowbridge.

BERKS.—December 16th.—For the supply of broken road materials, gravel and sand, for the county council.—Mr. A. Langston, Yockney, acting county surveyor, Shire Hall, Reading.

WEST SUFFOLK.—December 23rd.—For the supply of broken material (tarred and untarred), to be delivered at railway stations and sidings, for the county council.—Mr. W. Lionel Jenkins, county surveyor, Shire Hall, Bury St. Edmunds.

SOMERSET.—December 30th.—For surface tarring on main roads at various places, for the county council.—Mr. Gordon R. Folland, acting county surveyor, County Surveyor's Office, Wells.

DORSET.—January 7th.—For the supply of broken granite, basalt, quartzite, limestone, and tar-macadam, for the county council.—Mr. E. H. Habgood, acting county surveyor, County Offices, Dorchester.

Sanitary.

PONTEFRACT.—December 13th.—For scavenging work in several parishes, for the rural district council.—The Clerk.

FORMBY.—December 13th.—For the construction of a 6-in. sewer, for the urban district council.—Mr. T. Grime, surveyor.

SALFORD.—December 14th.—For works of sewering, for the corporation.—Borough Engineer, Town Hall.

SMALLTHORNE.—December 15th.—For the supply of 500 yds. of 9-in. glazed and socketed seconds sewerage pipes, for the urban district council.—Mr. G. Phillips, clerk.

CHORLEY.—December 15th.—For the supply of disinfectant fluid, for the corporation.—Mr. J. Mills, town clerk.

WALSALL.—December 16th.—For the construction of about 1,033 yds. of 9-in. stoneware pipe sewers, manholes, lampholes, and other works, for the rural district council.—Mr. W. P. Young, engineer and surveyor, Council Offices, Rushall, near Walsall.

MUTFORD.—December 29th.—For the removal of house refuse and night soil, for the rural district council.—Mr. W. B. Forward, clerk, 148 London-road, N. Lowestoft.

Stores.

BELFAST.—December 15th.—For the supply of hardware, paints, oils, timber, Portland cement, iron castings, and cartage, for the City and District Water Commissioners.—Mr. R. Hamilton, secretary, Water Office, Belfast.

WANDSWORTH.—December 16th.—For the supply of artificial stone, blue bricks, castings, cement, coal and coke, disinfectants, broken granite, granite kerb and setts, gravel and flints, house refuse collection, removal and disposal, iron bars, lime, bricks, oilman's goods, painters' materials, salt-glazed-ware pipes, scavengers' brooms, slag blocks, hire of steam rollers, sweepers' clothing, Thames ballast and sand, timber, tools, and wood-paving blocks, for the borough council.—Mr. D. A. Nicholl, town clerk, Council House, Wandsworth, S.W.

FROME.—December 17th.—For the supply of scavenging brushes, British Portland cement, broken granite, limestone, tarred slag, refined tar and other proprietary articles suitable for surface treatment of highways, tools, kerbing, channelling, Pennant and concrete flagging, and coal, for the urban district council.—Mr. F. W. Jones, surveyor, The Public Offices, Frome.

OTLEY.—December 31st.—For the supply of setts, kerbs, flags, granite macadam, pitch, tar, slag dust, tar-macadam, limestone macadam, and brushes, for the urban district council.—Mr. C. F. Hodgson, surveyor.

Miscellaneous.

WANDSWORTH.—December 16th.—For the collection, removal and disposal of house refuse, and the purchase of old tins, for the borough council.—Mr. D. A. Nicholl, town clerk, Council House, Wandsworth, S.W.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Limited. Price 10s. 6d.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.
‡ Provisionally accepted.

CUCKFIELD. Accepted by the urban district council:
Mountsorrel Granite Company, 150 tons of granite at 15s. 6d. per ton at Haywards Heath.
— Ogz, Haywards Heath. To haul 50 tons to Butlers Green at 1s. 5d. per ton.
— Pix, Cuckfield.—To haul 100 tons to the depot, at 2s. 4d. per ton.

WANDSWORTH. For making up and paving Heathfield-road, for the borough council.—Mr. P. Dodd, borough engineer:—
E. & E. Iles, £1,229, and 25 per cent above schedule prices for extras or omissions, including £1,100 for paving the portion of the road comprised in the new streets paving apportionment.†

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

DECEMBER.

10.—Institution of Water Engineers: Annual Winter Meeting, Burlington House, W. 2.30 p.m.
13.—Surveyors' Institution: Mr. M. C. Duchesne, hon. secretary of English Forestry Association, on "Timber During and After the War." 4 p.m.
13.—Society of Engineers: Annual General Meeting, 17 Victoria-street, S.W. 5.30 p.m.
14.—Illuminating Engineering Society: Prof. J. T. Morris on "Recent Developments in Electric Incandescent Lamps in Relation to Illuminating Engineering." Royal Society of Arts. 8 p.m.
17.—Institution of Mechanical Engineers: Paper, "Engineering Colleges and the War," by Messrs. R. Mullineux Walmsley, D.SC., F.R.S.E., Principal of the Northampton Polytechnic Institute, London, and C. E. Larard, Head of the Engineering Department, Northampton Polytechnic Institute, London. 6 p.m.

TENDERS WANTED.

METROPOLITAN BOROUGH OF WANDSWORTH.

TENDERS are invited for the PURCHASE of a 10-ton Aveling and Porter STEAM ROAD ROLLER. The Roller can be seen on application at Clapham Depot, 374A Wandsworth-road, Clapham, any day between the hours of 9 a.m. and 4 p.m. (Saturday 9 a.m. to 1 p.m.).

Tenders to be sent to the undersigned not later than Monday, December 13th next.

P. DODD,
Borough Engineer and Surveyor.

215 Balham High-road,
London, S.W.
November 26, 1915. (2,776)

COUNTY COUNCIL OF WEST SUFFOLK. MAIN ROADS.

Tenders are invited for the Supply of Broken Material (Tarred and Untarred), to be delivered at Railway Stations and Sidings in the County during the year ending 31st March, 1917.

Conditions of Contract, with Specification and Form of Tender, may be obtained on application to the undersigned.

Tenders to be sent in by 10 a.m. on Thursday, the 23rd December, 1915.

W. LIONEL JENKINS,
ASSOC.M.INST.C.E., P.A.S.I.,
County Surveyor.

County Surveyor's Office,
Shire Hall,
Bury St. Edmunds.
December, 1915. (2,785)

BERKSHIRE COUNTY COUNCIL. ROAD MATERIALS.

The Berkshire County Council ask for Tenders for the Supply of Broken Road Materials, Gravel and Sand, for the twelve months ending March 31st, 1917, delivered at the Railway Stations and Wharves in the County.

Upon receipt of a stamped addressed foolscap envelope, Forms of Tender, Lists of Stations and Wharves, and full particulars will be forwarded by the County Surveyor.

Tenders, endorsed "Tenders for Materials," to be sent in duplicate to the undersigned by December 16th, 1915.

The Council do not bind themselves to accept the lowest or any Tender.

The Contractor will be required, if his Tender be accepted, to enter into a Contract to be prepared by the Council's Solicitor, such Contract, if thought desirable by the Solicitor, to provide for two sureties. A specimen Form of Contract may be seen at the Office of the Clerk to the County Council, Shire Hall, The Forbury, Reading.

A. LANGSTON YOCKNEY,
Acting County Surveyor.

Shire Hall,
December 1, 1915. (2,780)

SOMERSET COUNTY COUNCIL. SURFACE TARRING ON MAIN ROADS.

Tenders are invited for Surface Tarring on Main Roads at various places in the County during the year 1916.

The work will be done partly under direct contract for the County Council and partly through the Rural and Urban District Councils, and probably about 160 miles of roads will be so treated.

Forms of Tender, General Conditions, and Specifications may be obtained from the undersigned, to whom Tenders, endorsed "Surface Tarring," must be delivered not later than Thursday, the 30th December, 1915.

The lowest or any Tender will not necessarily be accepted.

GORDON R. FOLLAND,
Acting County Surveyor.

County Surveyor's Office,
Wells.
December, 1915. (2,784)

THE FROME URBAN DISTRICT COUNCIL. TENDERS FOR STORES.

The above-named Council invite Tenders for the Supply of the following Materials for the year ending March 31st, 1917:—

Scavenging Brushes, British Portland Cement, Broken Granite and Limestone, Tarred Slag, Refined Tar and other proprietary articles suitable for surface treatment of highways, Tools, Kerbing, Channelling, Pennant and Concrete Flagging, and Coal.

Particulars and Forms of Tender may be obtained from Mr. F. W. Jones, ASSOC.M.INST.C.E., the Public Offices, Frome.

Tenders must, in all cases, be made on the prescribed Forms, and delivered at my Office, addressed to the Chairman of the Council, not later than 12 noon, December 17th, 1915.

The Council does not bind itself to accept the lowest or any Tender.

(By order)
H. E. AMES,
Clerk.

The Public Offices, Frome.
December 17, 1915. (2,786)

BLAST FURNACE SLAG
From 16 cwt. to 17 cwt. per cubic yard.
FOR TAR GRIT
Is the best material on the market to spread on the top of Tar Paving, to absorb spare tar, and prevent it being carried on footpaths. Note the weight per cubic yard.
JOHN FREAKLEY & CO., Ltd., Coneygre Slag Works, DUDLEY PORT, TIPTON. Telegrams "Freakley, Tipton." Telephone—No. 3 Tipton.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. DECEMBER 17, 1915. No. 1,248.

Minutes of Proceedings.

Preliminary Treatment of Sewage in Cultivation Tanks.

In making provision for the preliminary treatment of sewage prior to filtration, the tendency in recent years has been towards the prevention of putrefaction and the maintenance of the liquid portion of the sewage, as far as possible, in a fresh condition. It is now generally recognised that a septic tank effluent not only possesses no advantage over a fresh liquor in the subsequent process of purification, but is very likely to cause a nuisance from smell, both from the distribution of the liquid on the filters and from the disposal of the sludge. In spite of this, we find that Mr. W. D. Scott-Moncrieff, in the paper which he read at the annual meeting of the Association of Managers of Sewage Disposal Works, and which we printed last week, is of the opinion that putrefactive fermentation is the usual preliminary to final oxidation, and he definitely states that this is Nature's method. We are unable to agree with Mr. Moncrieff on this point. So far as we are aware, Nature's methods in the decomposition of organic wastes are entirely aërobic unless they are interfered with by human agencies. Sewage is, in our view, an unnatural product of civilisation. Water is used as a carrier for the liquid, and some of the solid, domestic, and other wastes, in order to convey them in the most rapid and efficient manner to a suitable distance from human habitations. These wastes frequently remain so long in the water that anaërobic conditions are produced and putrefactive decomposition is set up, but we do not think this method of disposing of these wastes would be adopted by Nature if left to herself. In our opinion the right principle to adopt is to separate the liquid from the solids as soon as possible after the sewage has arrived at the outfall, as it is certain that the liquid portion can be more readily purified the less it is fouled by the products of putrefaction. This is demonstrated by the fact that a highly diluted, and consequently "fresh," sewage is much more easily purified in filters than a concentrated foul sewage, and it is also undoubtedly one of the reasons why the Imhoff tank, in which this principle of preventing the fouling of the liquid sewage is carried out, has been so largely adopted in the United States during the last few years. For these reasons we believe that Mr. Moncrieff's insistence upon the necessity for putrefactive fermentation as an essential preliminary to oxidation in connection with the purification of the liquid portion of the sewage is a step in the wrong direction.

In dealing with the work he has carried out at Chertsey, the author refers to the "cultivation" tanks as having a capacity of "twelve hours' flow," which is confirmed by the dimensions of these tanks compared with the daily volume of about 300,000 gallons as given in the paper. We gather from some observations later in the paper that this sewage is delivered to the outfall works by pumping plant through a rising main, which must be of considerable length if it causes the sewage to be subject to "violent anaërobic conditions in which putrefactive gases are produced under pressure and pass into solution so as to give the liquid a maximum degree of offensiveness." It is also probable, as in most pumping schemes, that the pumping takes place during a portion only of each twenty-four hours, so that during the remainder of the time the sewage is stored in the pump well under anaërobic conditions, which naturally develop putrefactive fermentation. If these inferences are correct, we should expect this sewage to be in a condition in which anaërobic bacterial action was reaching its maximum, and to be approaching the state which is frequently termed "worked out." In such a condition the sewage would be of an abnormal character, and the results of the treatment described are no guide whatever to the effects which would be produced by the same treatment when dealing with ordinary fresh crude sewage. On the other hand, so many unsuccessful attempts have been made in the past to utilise upward filters for sewage treatment on the lines described by Mr. Moncrieff in his paper, that we shall be much interested in any further information which he may supply later on as to the effect of the special method which has been adopted for drawing off the effluent from the "cultivation" tanks at Chertsey. We have no doubt that the sewage contains a considerable amount of finely divided matters in suspension, and that much of this will be arrested by simple mechanical straining in the "cultivation" tanks. It will, however, be useful to know what other effects the special arrangements which Mr. Moncrieff has devised may have upon sewage of this exceptional character, especially with regard to the prevention of nuisance from smell in the course of the subsequent distribution upon the filters. It is worthy of note that, while Mr. Moncrieff advocates preliminary treatment by putrefactive fermentation followed by oxidation in filters, the method of disposal described in the second paper by Mr. W. H. Duckworth, read at the same meeting of the Association of Managers of Sewage Disposal Works, consists of one stage only, under entirely aërobic conditions produced by artificial aëration.

* * *

The Supply of Timber.

The announcement that a special committee has been appointed by the Government to consider the question of our supply of timber renders especially interesting the paper entitled "English Timber: Before, During, and After the War," read by Mr. M. C. Duchesne at a meeting of the Surveyors' Institution last Monday evening. Mr. Duchesne's main theme was that the present unsatisfactory condition of the markets for English timber is due to two principal causes—namely, lack of organisation of the available resources and supplies, and failure to make the best use of all the possible markets. At one time—and that not so very many years ago—with the single exception

of oak for the Navy, English timber was almost invariably sold to the local merchant for his local trade. Now, however, that native timber has been replaced by foreign for nearly all local purposes, the natural markets are to be found with big wholesale firms and in the great industrial centres. It is evident, therefore, that new methods must be sought, and it is equally evident that hitherto the timber trade has failed satisfactorily to adapt itself to the new conditions. If success is to be achieved, native timber must be as easily procurable as are the well-organised foreign supplies, and with proper organisation there seems to be no reason why larger openings than ever should not be found for all English varieties.

An examination of the prices paid for imported timber in recent years, including the war prices of the present year, shows that the common qualities have all advanced in a much higher ratio than the better grades, and that small sizes have advanced more than large sizes. This all points to a new opportunity for the home-grown article, and the real problem is how best to take advantage of the situation thus presented. Mr. Duchesne enumerated certain difficulties that have to be overcome, chief among these being high railway rates and lack of capital. The latter is due to the fact that many of the largest merchants are now interested only in the foreign trade. Once it can be shown, however, that the home trade is capable of real expansion, capital should be attracted, and then with organisation a real improvement should be possible. As Mr. Duchesne said in regard to oak, the present stagnation is due to a succession of unfortunate circumstances. The architect and consumer complain of the difficulty or impossibility of getting the timber, and of there being no firm generally known to stock it. The contractor and builder inform them that supplies of English oak are not available, and persuade them to accept the readily obtained foreign timber. The large merchant says he is not asked for it, and the local merchant complains that there is no demand for it, and so the vicious circle is completed. In these circumstances it is satisfactory to know that the English Forestry Association have formed a special committee to deal with the whole question. This association was formed to investigate and find a solution of the forestry problem, and, being an independent and influential expert body, would appear to be peculiarly fitted to undertake the important work outlined in Mr. Duchesne's able and exhaustive paper.

* * *

Domestic Purposes.

In a recent issue we directed attention to the negative form in which the term "domestic purposes" is defined in various special Waterworks Acts, and to the remarkable diversity in the several Acts as to the nature of the services that are deemed to be non-domestic. Mr. Pilling, the clerk to the Metropolitan Water Board, in a paper which he read some time ago before the Municipal Waterworks Association, emphasised the desirability of securing greater uniformity in the interests both of undertakers and the public. The question, which owing to recent decisions in the Courts is one of some urgency, was further discussed last Friday at the winter meeting of the Institution of Water Engineers, being introduced by an able and suggestive paper submitted jointly by Mr. A. B. E. Blackburn and Mr. Percy Griffith. The authors dealt with the matter on broad lines, and gave the fairest possible consideration to the just interests of the consumers, who, although practically dumb through lack of organisation, are every whit as much concerned to find a satisfactory solution of the problem as are the water authorities. In our issue of October 8th last we endeavoured to show the historical reasons for the present unsatisfactory form of definition—namely, the early realisation of the principle that a sufficient quantity of water for domestic use must be supplied to every household in the interests of public health, and that for the same reason payment for this supply should be graduated according to the financial ability of the consumer rather than the quantity consumed. It thus appears that there are two distinct questions involved in the discussion—namely, (1) for what purposes water authorities ought to be under an obligation to afford a compulsory supply; and (2) for what purposes in the interests of public health the charges should be based solely on the consumer's ability to pay.

We entirely agree with the statement in the paper of the main objects to be kept in view in any general amendment of the law that may be made. These, as stated, are, first, the introduction of a comprehensive, yet indisputable, definition of the purposes (not all purely domestic) for which water must be supplied compulsorily; secondly, a practicable method of supplying such water separately from the non-compulsory supply as far as may be necessary; and thirdly, a system of scale of charges which would be equitable as between different classes of consumers, of general application as regards the principle, and yet sufficiently elastic to provide for the varying conditions of different localities and different sources of supply. When an actual definition on these lines is attempted, however, difficulties at once arise, and these are frankly discussed by the authors. The whole question is a very thorny one, and requires very careful handling if the interests of all concerned are to be properly safeguarded.

* * *

Arterial Roads in Greater London.

The extreme urgency of the problem of arterial roads in Greater London is shown by the fact that the main roads at present available are substantially the same as those which served eighty years ago. Any improvements that have been made have been of a most expensive description, and generally they have only been undertaken in cases of the most urgent necessity. It would be difficult to estimate the total amount of money spent in recent years in widening streets, the narrow construction of which might have been prevented by the exercise of a little foresight, and if an even greater waste is to be avoided in the future the question of arterial roads must be tackled in a statesmanlike way and with full regard to modern traffic conditions. As Mr. W. R. Davidge, the district surveyor for Lewisham, pointed out in the paper on the subject which he read before the Town Planning Institute on Friday last, the proposals of the London traffic branch of the Board of Trade are the first real steps towards a much belated reform of the arterial roads in Greater London. The intrinsic merit of these proposals, as they were originally put forward, is shown by the comparatively slight alterations that have been made as a result of the conferences that have been held with local authorities and others interested. We hardly agree with Mr. Davidge, however, in his suggestion that local authorities are so apt to be swayed by local or parochial considerations only that it is dangerous to consult them at all in a matter which ought to be looked at from a broad point of view. Such a suggestion is not warranted by the way in which the Board of Trade proposals have been received and considered locally, while in many cases the local knowledge of councils and the suggestions of their officials have proved to be of very great value.

Perhaps the most important of the new proposals are those for the construction of entirely new routes. It is to be hoped that in laying out these roads the mistakes of the past will not be repeated by allowing narrowness or congestion at any given points. They must be regarded as great highways for modern fast traffic, and must

be designed for that purpose only. This not only involves adequate or even generous width, but also a strict limitation upon the number of cross roads, every one of which necessarily acts as an interruption of the main traffic stream. As Mr. Davidge truly said, the requirements of a main road are approaching more and more nearly to those of a railway, and if they cannot be kept entirely free for high-speed through traffic, they must at least be protected by a strip of grass or low shrubs from the traffic coming from cross roads. In the course of the discussion that followed the reading of the paper several speakers emphasised the connection between arterial roads and town planning, and urged the necessity for compulsory town planning schemes in certain areas. We hope to deal more fully with this aspect of the question in a future issue.

* * *

Iowa State Highway Commission.

The first annual report of the Iowa State Highway Commission covers a period from April, 1913, to December, 1914, and forms a most interesting record of the beginning of the work of systematising highway administration in the State. The statute by which the commission was constituted was intended to form the foundation on which to build a practical system of highway law. It was not to be expected that the original Act would be so perfect as to be incapable of improvement, so that, although a two years' experience has shown that certain amendments are desirable, it may fairly be described as a highly successful piece of legislation. Prior to the establishment of the commission there existed an organisation by which it was possible to make a broad study of the needs of the State, and a good deal of useful information was gathered. In their earliest days, however, the activities of the commissioners were necessarily directed to a broad enforcement of the law, but with the division of the work into departments more detailed activities became possible. For example, the designing department, as developed by the commission, is the outgrowth of the demand for plans for road and bridge work which had been gradually increasing under the former commission from year to year, until at the time the new road law was passed the demand for such plans far exceeded the resources of the former organisation to supply. The field department was organised to conduct the field engineering work and to represent the commission personally in all the various phases of highway work. Then an educational department has been set up for the purpose of disseminating information and instruction to county supervisors and other highway officers on questions pertaining to highway improvement and reasonable prices for materials and construction. This would appear to be most useful and necessary work in a comparatively undeveloped country, and it is being prosecuted in characteristic fashion. Thus, a typical programme for a "good roads day" includes among other items a "picnic supper for everybody." To sum up, it is very satisfactory to note that as time passes criticism of the new road law is giving way to a fairer consideration of the principles involved, a result which is chiefly due to the splendid work already accomplished by the commission.

* * *

The Aberdeen Burgh Surveyorship.

In addition to a vehement agitation *pro* and *con* their great scheme of water supply, the Aberdeen Town Council have been stirred lately on the question of the amalgamation of the offices of burgh surveyor and water engineer. In the abstract much may be advanced in favour of amalgamation, but in this as in other matters circumstances alter cases, and we are bound to admit that an overwhelming weight of evidence would appear to be on the side of the Special Committee which reported against the proposal. The question of economy had considerable weight with many of the councillors, who advocated and voted for the dual system, but the discussion in the city council does not afford convincing evidence that either these gentlemen or their opponents had very stable ground to stand upon. While on one hand the assertion was freely made that amalgamation would bring about an annual saving of £772 a year, this was countered by the reply, on the other hand, that any such estimate was absolutely erroneous and misleading. One fact does emerge conspicuously from the debate—which lasted some three hours—and this was that, while in Mr. Roberts the corporation possess an excellent water engineer, it is equally undeniable that he has, and will have for some time to come, his hands quite full with a large water scheme to which he will be expected to devote his undivided attention. This fact alone might have given pause to that section of members who voiced the proposal for amalgamation with such a wealth of strenuous language.

The argument for the separation of the offices was, we think, put forward with great cogency by Mr. Reith, who seconded the proposition of the Lord Provost for the adoption of the report of the Special Committee. While maintaining that it was in the interests of the city that the departments should remain separate, he contended that amalgamation would mean that an official who had rendered long and faithful service to the corporation would be superseded. This had reference to the work of Mr. Gordon, assistant burgh surveyor, who was nominated for and eventually appointed to the position of burgh surveyor. On the whole there seems to be little doubt that the city council did the right thing in adopting the report of the Special Committee by a majority of twenty-one against nine. Any idea that there would be less work in future in the burgh surveyor's department than there had been in the past will depend in a great measure upon the qualities which Mr. Gordon will bring to the discharge of his new duties as chief officer. We do not suppose Aberdeen has attained to such a position of administrative perfection that there will not be opportunities offered him in plenty to prove the stuff he is made of.

* * *

A Question of Salary.

The town council of Portknockie, Banff, were asked at their last meeting to fix a proper salary for the combined offices of burgh surveyor and sanitary inspector, and to secure that henceforward the work and duties pertaining to those offices shall be performed with efficiency. It appears, however, from a letter which was published in a recent issue of the *Aberdeen Journal*, that, "with the usual lack of business promptitude, settlement of the matter was deferred till the next meeting." The writer then proceeds to point out that the burgh is growing, and so requires more attention than a town that has ceased to expand, and further that schemes for a harbour and for a water supply are matters of practical local politics. There is thus no reason, he continues, why the services of a properly qualified surveyor should not be obtained at a remuneration of—10s. per week! "Of course, a man who has no qualifications and is incompetent is dear at any price, and could not be tolerated." It is only fair to add that the suggestion is only for the appointment of a part-time official, but even so it would seem that "properly qualified surveyors" in private practice across the border must be in a very bad way if it is hoped to tempt them by an offer of this character. We cannot conclude better than by repeating the closing words of the letter from which we have already quoted, "Let Portknockie flourish!"

Notes on the Definition of the Term "Domestic Purposes" in General and Private Water Acts.*

By A. B. E. BLACKBURN and PERCY GRIFFITH.

Having collected a considerable mass of data relative to the various applications and definitions of the term "domestic purposes" at present incorporated in general and private Water Acts, the authors have accepted an invitation from the council to prepare some notes on the subject for presentation at a meeting of the members with a view of opening a discussion thereon. It must, however, be clearly stated that these notes do not represent the views of the council, and are to be considered, not in any way as an official report to the members, but merely as a summary of points open to discussion.

As the question of defining the term "domestic purposes" is one in connection with which the interests of water authorities and consumers frequently come into conflict, while at the same time the interests of the public health suggest considerations independent of both, it will be generally conceded that the subject must be approached and discussed on the broadest lines.

The essential difficulty of the problem in this country arises from the impossibility of charging for water supplied for domestic purposes on the basis of quantity consumed. The public interests are generally admitted as demanding: Firstly, that a quantity sufficient for health must be supplied; and, secondly, that the payment for this quantity must be adjusted according to the financial position of the consumer rather than to the actual amount of water consumed. Thus, the charges for a "domestic" supply are usually based upon the annual (rateable) value of the property, but, as a directly proportionate charge would create an excessive disproportion between the charge and the consumption, the scale usually varies between 5 per cent and 10 per cent of the annual (rateable) value, but in inverse ratio thereto. This system has been applied, with slight adjustments to meet special cases, almost universally, the most prominent exception being the Metropolitan Water Board, who, in their Act of 1907, adopted a uniform rate of 5 per cent. This uniform rate, however, has aroused considerable opposition in certain cases, and has resulted in many consumers providing themselves with private supplies of water; thus it may be fairly claimed that, as the normal system has successfully stood the test of experience without creating any general hostility or justifying serious criticism, no change is at present called for. While, however, the present method of charging for "domestic" supplies of water may on the whole be regarded as satisfactory, it is otherwise with the method of differentiating between "domestic" and "non-domestic" supplies.

It may here be of interest to recall the circumstances under which the term "domestic," as applied to water supply, has come into use. In the earlier Acts of the Metropolitan water companies no charges were stipulated, and the supply of water was a voluntary arrangement between the consumers and the companies. Scales of charge based upon the number of rooms in the house were later introduced, this number being arrived at by the number of chimneys, in order to avoid the necessity for the internal inspection of the premises by the water companies' officials. Then followed the addition of special charges for high service, baths, water-closets, &c., as well as for trades requiring an extra consumption of water, the whole being a question of mutual agreement, and not of statutory charges.†

In the year 1847 the position of all existing and future water companies was standardised by the Waterworks Clauses Act of that date, into which was introduced the important factor of compulsion on the water authority to "provide and maintain a supply of pure and wholesome water sufficient for the domestic use of all the inhabitants," all other supplies (except water for municipal purposes and fire-extinguishing) being permissive. This Act made no provision for charges beyond stipulating that domestic supplies were to be paid for by a rate based on the "annual value of the tenement," water used for municipal purposes was to be paid for upon such terms as might be agreed upon, or, in case of disagreement, as should be settled by two justices, and water for fire extinguishing was to be supplied without charge. The Act of 1863 standardised certain purposes as being "non-domestic," and these were consequently rendered non-compulsory and subject to agreement as regards payment.

The position has since remained unaltered as regards the general waterworks law, but private Bill legislation has introduced many variations, some peculiar to certain undertakings, others, however, being subsequently standardised by incorporation in the Model Water Bill. In fact, the Model Water Bill has played an important part in the whole question, because, by standardising certain clauses which experience has shown to be necessary, and of general application, it has up to the present obviated the necessity for revising the general waterworks law. It will, no doubt, be generally agreed that, whether any alteration of existing conditions in regard to the definition of "domestic supply" is necessary or not, the time has now arrived when the general law should be brought into closer conformity with generally accepted practice.

Reverting to the question of "domestic" supplies, the most important factor in the general waterworks Acts is the obligation imposed on the "undertakers" to afford a supply. In these Acts the compulsion applies solely to "domestic" and municipal supplies and to water used for fire extinguishing; but several Private Acts have incorporated compulsory clauses relative to "non-domestic" supplies, the most important being the Sheffield Waterworks Act, 1853 (sec. 81); the Staffordshire Potteries Waterworks Consolidation and Extension Act, 1853 (sec. 47); and the Metropolitan Water Board (Charges) Act, 1907 (sec. 16), the rates of charge being stated in each case. Where no compulsion exists, the water authority has absolute discretion as regards the charges for "non-domestic" supplies, being free to refuse the supplies unless its terms and conditions are complied with in each particular case.

THE PUBLIC HEALTH POINT OF VIEW.

Considering the question of compulsion apart (for the moment) from that of charges, and taking the broader view suggested by the modern requirements of public health rather than that of the consumer anxious to resist an extra charge, or that of a water authority anxious to maintain or increase its revenue, it cannot be denied that modern ideas of sanitation involve a much larger consumption of water for domestic purposes than they did in the year 1847, and this extra supply has generally been afforded without demur by the water authorities. At the same time there is no doubt that there has been a general, and in most cases an extraordinary, increase in the demand for trade purposes (supplied at remunerative rates of charge), and also an increase in the annual (rateable) values upon which the domestic supplies are charged. For these reasons it is possible that some considerable extension of the domestic use of water might be permitted without any protest from water authorities generally, as it must be admitted that water authorities have, for the most part, considerable scope in the direction of preventing waste and improper use of water by consumers. Nevertheless, it may fairly be asked whether it is not time to reconsider the whole question of domestic charges on its merits, and devise some method, firstly, of limiting the application of the term "domestic purposes;" and, secondly, of adjusting (if necessary) the rates of charge as between "domestic" and "non-domestic" user. From the point of view of public interest there should not be any question of competition between the claims of water authorities and consumers respectively. It may be assumed that the revenue of any water authority (whether municipality, joint water board, or company) is already sufficiently governed by statute to prevent the necessity for any material diminution thereof; consequently, any modification of existing conditions must be in the nature of an adjustment as between one class of consumer and another. This assumption

* Paper read at the Winter General Meeting of the Institution of Water Engineers held in London on Saturday last.

† The authors are indebted to a report by Mr. A. B. Pilling, the clerk to the Metropolitan Water Board, published in July, 1915, for the historical data contained in this paragraph.

[illegible] view of public health.

The development of modern sanitation in the direction of providing water-closets and private fixed baths for even the smaller tenements, as well as the closer supervision of the internal sanitary conditions of all classes of property, including factories, workshops, &c., tends inevitably to the more liberal use of water for purposes which, in the interests of public health, must be classed as "domestic" (using the word in its original and broader sense). The first question to consider is therefore: To what extent ought the term "domestic purposes," as used in general and private water Acts, to be interpreted to include all water required in the interests of public health?

As to the [illegible] regarding the matter apart from the question of charges, it may fairly be claimed that all water required to maintain cleanliness, both of persons, utensils and inhabited premises, as well as that necessary for private sanitary and culinary use, should be considered as coming under the term "domestic supply," and that such water should therefore be supplied compulsorily in the interests of public health. The further questions of what quantity of water and what specific uses of water are to be considered as essential to health should be carefully considered and settled by sanitarians, just as in the matter of defining the term [illegible] should be fixed by the chemists and bacteriologists. The water engineer will then know what is required of him, and be able to definitely calculate his liabilities both in regard to quantity and quality. At the present time the lack of agreement in the matter of purity, and the absence of any standard of quantity required for health purposes are frequently causes of dispute or misunderstanding, and the authors suggest that, until some standards have been adopted by common consent, the problems of defining "domestic supply" and "pure and wholesome water" must to some extent remain unsolved.

CONSUMER'S POINT OF VIEW.

Let us next consider the subject from the consumer's point of view. It must not be forgotten that in civilised communities the interests of the individual cannot be dissociated from those of the community at large, and in regard to water supply the individual consumer must be prepared to pay his fair share of the cost of water which is necessary for the maintenance of the public health. Moreover, in order to relieve himself and his neighbours from excessive or unnecessary cost, the consumer must be prepared to co-operate with the water authority in checking waste or improper use of water, and to accept without complaint such supervision of his water fittings or use of water as may be necessary to enable such waste or improper use to be detected and prevented. This feature of the case becomes of particular importance when we consider the subject from the water engineer's point of view; but the consumer must be involved in any practical scheme for differentiating between the water used for "domestic purposes" and that used for "non-domestic" or "extra-domestic" purposes, whatever may be decided upon as the proper dividing line between the two. As regards payment also the consumer must be made to realise that in securing any extension of his "domestic" water supply he is not being relieved of the necessity of bearing his proper share of the total cost, nor obtaining any advantage as against the water authority or the community as a whole. Any extended use of water for domestic or health purposes should be considered as a necessity in the public interest, and not as a personal convenience or luxury to the consumer, and he should also, in his own interest as a member of the community, be willing to restrict his demand for and use of water to those purposes which are strictly necessary, and to pay for any additional consumption as a convenience or luxury, according to value received. Whether these ideals can be carried out on practical lines is, of course, open to discussion.

THE WATER ENGINEER'S POINT OF VIEW.

Turning now to the water engineer's point of view, the difficulties of differentiating between "domestic," "extra-domestic" and "non-domestic" supplies at once become very evident. In order to appreciate them more clearly it will be convenient to eliminate those cases which do not present any difficulty at all. First among these are the cases of undisputable "trade" supplies. In all manufacturing areas a considerable proportion of the water supplied is used for exclusively trade purposes, and in cases of factories and workshops occupied only during working hours the only difficulty which arises is to what extent water used in water-closets, lavatories, and for scrubbing the premises should be considered as "domestic supply." In this connection the question of compulsion must be considered apart from that of charges. The sanitarian may fairly claim that water so used is necessary in the interests of the public health, and should be supplied under compulsion, and therefore it is not right that the water authority should have power to refuse such a supply unless it is taken on their own terms and conditions. It seems a fair subject for discussion whether or not trade supplies (which may be assumed as universally metered) should be considered as compulsory so far as they may be required or used for "domestic" or health purposes. It may be pointed out that in the case of all supplies made compulsory by statute the scale of charge, or, at any rate, a maximum rate of charge, is also invariably settled by statute. It does not, however, appear to the authors that any serious difficulty arises in meeting the conditions above referred to, although, of course, the making of trade supplies even partially compulsorily would be an important change in present Parliamentary practice.

Another, although much smaller, class of supplies which presents no essential difficulty is that of private residences (particularly small properties without gardens or stables) where water is used for "domestic" or health purposes and for nothing else. We [illegible] agreed that water used for water-closets and private fixed baths should be considered as "domestic" supplies, this class would be considerably extended, and the problem would be to that extent simplified. This, however, is a question upon which discussion may be useful and interesting.

The third and largest class of supplies, as to which the practical difficulties are at first sight most apparent and insuperable, is that of premises where water is used both for "domestic" and "non-domestic" purposes. In this must be included the private residence with a needless multiplicity of lavatories and other sanitary conveniences, with gardens, greenhouses, stables, ponds or fountains, the combined residence and shop (whether for work or sale of goods), the factory, with a resident caretaker or workpeople, and hotels, inns and restaurants. In such cases the "non-domestic" supply cannot economically be metered, at any rate as a general rule, and it becomes a question of great practical difficulty how to differentiate between the "domestic" and "non-domestic" supplies, both in regard to compulsion and to scales of charge.

Specific cases of restaurants, workhouses, schools, laundries, &c., have been decided in the courts on their individual merits, and while the decisions in such cases cannot be accepted as of universal application (indeed, the decisions in the cases of *Metropolitan Water Board* v. *Avery*, and *Metropolitan Water Board* v. *Oddenino* appeared to the lay mind absolutely contradictory), the arguments used by counsel and justices in the various cases afford interesting reading to anyone anxious to analyse the ethical basis of the present legal position. To the water engineer the reading of these cases can only enforce the conclusion that at present the law relating to "domestic supply" is hopelessly vague and unconvincing, and the authors venture to suggest that the explanation lies in the fact that up to the present no serious attempt has been made to define the essential principle underlying the use of the term "domestic supply" in waterworks law.

This problem, however, is not primarily one for the engineer, and it must be left to the Legislature, guided by the sanitarian, to prescribe the dividing-line between "domestic" and "non-domestic" purposes in regard to water supply. Nevertheless, it is not inopportune for the water engineer to intervene at this stage in order that he may indicate to the Legislature the practical difficulties which ought to be considered before any new or more drastic enactments are made, and this paper has been prepared mainly to enable members to express their views as to the best method of meeting the case, having regard to the interests of public health and the consumer on the one hand, and of the water authority on the other.

MAIN OBJECTS IN VIEW.

The main objects in view appear to be, firstly, the introduction of a comprehensive, yet indisputable, definition of the purposes for which water must be

supplied compulsorily; secondly, a practicable method of supplying such water separately from the non-compulsory supply as far as may be necessary; and, thirdly, a system or scale of charges which would be equitable as between different classes of consumers, of general application as regards the principle, and yet sufficiently elastic to provide for the varying conditions of different localities and different sources of supply.

The authors venture to suggest that these problems will shortly have to be faced, and that, unless those responsible for the water undertakings of the country are prepared to consider them in a practical manner, it is probable that the Legislature will take some action which will seriously disturb the present system of supply and method of charging, and possibly cause further complications and difficulties which the waterworks engineer and manager will have to unravel and overcome as best he may. It is, moreover, to the interest of the waterworks engineer to simplify as much as possible the legal or statutory obligations of water authorities in regard to their consumers, and thus avoid the uncertainty and confusion which now so generally prevail. Any alteration in the law should certainly have in view, not only the interests of the water authorities and their officials, but also those of the public, who suffer quite as much from the present condition of affairs.

Should the discussion furnish material from which a practical scheme for reforming the existing waterworks law could be drawn up, the authors do not doubt that the council would seriously consider the best means of promulgating such a scheme and assisting the Legislature to give effect to it; but, in any event, they are confident that the discussion should prove both fruitful and interesting to water engineers, as well as to others concerned in the question of public water supplies.

Having stated the main objects in view, and assuming the desirability of attempting to carry them into effect, the authors propose to consider the points in some greater detail, and particularly to mention some of the suggestions that have been made in connection with each.

1.—Definition of the purposes for which water should be supplied compulsorily.

The term "domestic" is here purposely omitted because it seems desirable that in any revision of the general waterworks law the element of compulsion should be dealt with specifically, and it is assumed that water required for municipal purposes (sewer flushing, road watering, &c.) and for fire extinguishing would remain under this heading with perhaps a more convenient basis of charge for the former than is now suggested in the Act of 1847. Possibly the members present may wish to question the obligation to supply water for fire extinguishing free of charge, but generally these two classes of compulsory supply do not appear to call for much comment.

The present method of defining "domestic purposes" is, however, generally admitted to be unsatisfactory, and mainly because it is almost exclusively in the negative form. This form is objectionable in that, unless every other possible use for water is specified, the definition must be incomplete. The authors have collected many suggestions for a positive definition, but all seem to be open to adverse criticism; nevertheless, a few specimens may perhaps facilitate discussion and elicit further and more suitable definitions.

(*a*) "A water supply for domestic purposes shall mean a supply laid on to private premises for the usual family purposes of the household and no other."

(*b*) "A water supply for domestic purposes shall mean and be limited to water used exclusively in providing for the personal, sanitary, culinary and ablutionary requirements of residents."

(*c*) "The term 'domestic purposes' shall mean the purposes for which water is required to be supplied to premises used partially or wholly as private dwelling-houses, and shall apply only to such a supply of water as is necessary to the health and comfort of the persons resident in or occupying such premises."

Definition (*a*) would seem to raise a vista of further litigation, as it involves the defining of "usual family purposes."

Definiton (*b*) has the merit of simplicity, as it deals solely with the purposes for which the water is to be used, but in practice it would raise endless difficulties, as its meaning is qualified by confining the domestic use to residents without any reference to the character of the premises supplied. It would seem to be difficult to arrive at a satisfactory definition which is not twofold in character, involving reference to and limitation of both the purposes for which the water may be used and the nature of the premises to be supplied.

Definition (*c*) covers these two points, but here again it would be necessary to have a decision on what uses of water are covered by the words "necessary to the health and comfort." In connection with this definition it will be useful to consider how far water authorities should, in the interests of public health, abandon the standard clause which entitles them to refuse to supply except by measure "any building used by an occupier as a dwelling-house, whereof any part is used by the same occupied for any trade or manufacturing purpose for which water is required."* In all such cases water for "domestic purposes" should, in the interests of the public health, be supplied compulsorily, and the only difficulty that arises is how far the "non-domestic" supply could be, in case of necessity, restricted. (The question of charges will be dealt with later.) The provision of separate services would be in most cases extremely inconvenient and costly, and the use of meters on *all* "non-domestic" supplies is also out of the question. Nevertheless, the water authority may reasonably ask for power to restrict the supply of water for such purposes in all cases where meters are not applicable, and the question is how can this be effected otherwise than by charging sufficient to cover excessive consumption, as is now done. This question leads naturally to the second problem—viz.:—

2.—To what extent is it necessary or possible to supply water for "non-domestic" or "extra-domestic" purposes separately from that required for "domestic" purposes?

A suggestion has been made that a given quantity of water (calculated proportionately to the number of residents) might be adopted as a reasonable consumption requisite for "domestic purposes," and that all excess consumed should be considered as "non-domestic," but this involves the necessity of (at least periodically) measuring the consumption, and the further difficulty of arriving at a fair allowance for "domestic" use. Undoubtedly a separation of the two supplies would overcome many difficulties, both as regards restriction of use and charges, and the question how far such a proposal could be carried out is perhaps worthy of discussion, even if it is found that the difficulties of its adoption prove insuperable.

3.—The best system of charging for "non-domestic" or "extra-domestic" supply.

In view of the suggestions made in regard to extending the application of the term "domestic purposes," it is necessary to point out that any appreciable increase in the quantity of water to be supplied compulsorily, and under the usual scale of charge for "domestic use," must involve a reasonable increase in the percentages on annual (rateable) value now in common use. Should the Legislature move in the direction indicated, this claim would no doubt be taken into consideration. As regards "non-domestic" or "extra-domestic" charges, however, practice differs widely, owing to the fact that all such supplies are optional, and subject to agreement. The publication of "Tables of Special Charges," and the power to refuse such special or "non-domestic" supplies except on payment of such published rates, considerably negatives the idea of agreement between water authorities and consumers, as it practically gives the former full discretion to charge as they may see fit. Now, it may be reasonably urged that many "non-domestic" uses of water are beneficial to the community, as, for example, supplies to trades which may be attracted to a particular area because the charges for water are low. Then it may also be urged that charges for similar purposes should be uniform in any given district, so as to avoid preferential treatment to particular consumers, and generally it may be claimed that special charges should have some more definite statutory authority than is now the case.

Is it not therefore desirable to consider carefully the conditions affecting the various "non-domestic" or "extra-domestic" supplies, and as far as possible to classify them under heads such as the following?—

(*a*) Those to be supplied only by measure;

(*b*) Those to be charged for by an increase or decrease of the "domestic" scale;

* Model Bill (1914) clause 16.

(c) Those to be charged for by an annual or quarterly sum; and

(d) Those to be charged for on other terms—that is, by mutual agreement where not specifically provided for in the private Act.

Such a classification might be of general application, and thus secure the advantages of uniformity and simplicity.

The actual charges could not, of course, be standardised; but it is suggested that it should be a more general practice to schedule special charges to Private Acts, so that there could be no doubt as to the charges being authorised by statute. To avoid the inconvenience and expense of promoting a Private Bill when it was desired to alter the charges or add new items to the list, it seems to the authors that alterations of the special charges might be made from time to time, subject to the approval of the Local Government Board.

The authors fully realise the complex nature of the subject, and that many of the suggestions contained in the latter portion of these notes may appear crude, impracticable, and perhaps unnecessary; but they have ventured to introduce these few points to facilitate discussion, hoping that members, by their criticisms and suggestions, may supply far more useful material than anything contained in this paper.

ALLOWANCES TO MUNICIPAL EMPLOYEES ON SERVICE.

METROPOLITAN COUNCIL SURCHARGED.

In the House of Commons, on the 8th inst., the President of the Local Government Board was asked whether his attention had been called to the threatened surcharge on the members of the Camberwell Borough Council in respect of payments to workmen and officials who were serving with His Majesty's Forces, and whether, having regard to the fact that on the strength of the promises made to them workmen and officials had been encouraged to enlist, he would now instruct the auditors of the board to refrain from threatening any surcharge in respect of financial assistance which was accorded by local authorities to any of their employees who joined the Colours.

Mr. Long said he understood an appeal had been, or was about to be, made against the surcharge, and he proposed to give the matter his immediate attention.

Mr. Chancellor: Will the right hon. gentleman also at the same time make an inquiry into the case of the Shoreditch Borough Council; they have had to break this particular contract with members of their staff who have joined the Army in consequence of the surcharge?

Mr. Long: I do not know whether I can promise to look into every case myself. An appeal can be made: it lies with me. As soon as an appeal is made I will at once have the whole matter looked into.

Mr. Crooks: Will the right hon. gentleman not make a general order in connection with the matter?

Mr. Long: No, Sir; I do not think I can be asked to do that, because it is conceivable that some may go far beyond the promises originally made or the obligations entered into. But hon. Members may be certain that in my investigations I shall be governed by a desire to see that all promises made are faithfully kept.

Modernisation of Power Plant in Factories. Mr. W. A. Tookey, M.I.MECH.E., chairman of the Junior Institution of Engineers, is to read a paper for discussion on the above subject on Monday, December 20th, at 7.30 p.m., in the hall of the Institution of Electrical Engineers, Victoria-embankment, S.W. The paper will be of interest not only to engineers, but to factory owners and manufacturers generally. It alludes to the waste that has been a somewhat usual feature of industries hitherto, points out how savings can be made, and carefully weighs the financial, industrial, and technical consideration in a manner which can readily be comprehended. Strong emphasis is laid upon the vital importance of maintaining and increasing British industry and enterprise in the immediate future, and not the least acceptable portion of the paper will seek to show how the State can do much to assist smaller manufacturers, whose lack of ready capital often hinders real progress. Tickets of admission to the meeting may be had on application to the Secretary, the Junior Institution of Engineers, 39 Victoria-street, Westminster, S.W.

THE MANUFACTURE OF PORTLAND CEMENT.

INSTITUTION OF MUNICIPAL ENGINEERS DISCUSSION.

The subject of the manufacture of Portland cement came before the Institution of Municipal Engineers at the recent annual meeting of that body, being introduced in a paper presented by Mr. Horace Boot, M.INST.C.E., M.I.E.E., past-president. Mr. Henry C. Adams, M.INST.C.E., M.I.MECH.E., the president, occupied the chair during the proceedings.

Portland cement as manufactured by Joseph Aspden in the eighteenth century was, said Mr. Boot, in the course of his remarks, a very different article to that which would pass the standard specification to-day. For it was not until some years later that there was any necessity for a proper uniform mixing of the ingredients, or a mixture that would not vary more than 1 per cent in the whole year; nor was it considered necessary to grind to such fineness, or burn the slurry so thoroughly as was done to-day. Chemists had made a special study of this, and in all first-class cement the proportion of chalk or limestone to the silica alumina and ferric oxide must never vary more than 1 per cent. The cement industry had been entirely revolutionised by the use of the rotary kiln, for the labour employed was reduced to a minimum, and a much more uniform and even burning of the cement was possible. The result was that, for ferro-concrete work, rotary-kiln cement was nearly always specified, and would command a higher price than the other kind burned in brick kilns. With the modern rotary kiln, Mr. Boot added, it was possible to run a cement works having an output of 2,000 to 3,000 tons per week, with a staff of only thirty men per shift; whereas for the same output with the chamber brick kilns this number of men would have been necessary for working the kilns only.

The PRESIDENT (Mr. Henry C. Adams), in inviting discussion, remarked that the information given in the paper would be useful to members in their dealings with cement manufacturers.

Mr. D. B. BUTLER, in proposing a vote of thanks to the author, said he agreed with Mr. Boot that cement was becoming of the very greatest importance; he thought he might say that Portland cement nowadays was almost indispensable to the modern engineer. He was glad to know that visits had been paid by the institution to various cement works, for that was the very best way that members could get to know the "ins and outs" and a knowledge of the methods of manufacture, and be able to meet the manufacturer on his own ground. Mr. Boot had stated that it was not until several years after it was first manufactured that there was any necessity for a proper uniform mixing of the ingredients of cement. His own view was that the necessity existed, but attention was not given to the matter. The cement obtained from the Cambridge marl had been spoken of as the nearest approach to Nature's raw cement. Cement was made of this some years ago, but, owing to the lack of proper methods of mixing and blending, only a very variable material was obtained. The chief centres of cement manufacture were the Thames and the Medway, and he thought 90 per cent of the entire English output came from those districts. The reason for that was to be found in the unlimited supplies of raw material in those two areas; as Mr. Boot pointed out, it was necessary to place the works where the raw materials were most available. Another reason why such a large proportion of the cement works were on the Thames and Medway was the unparalleled water-carriage. The description in the paper of the dry process was distinctly brief, although, of course, that process was not used now so much as it was. In the wet process the material was not always finished, as Mr. Boot had said, by passing the slurry through wet tube mills, and he did not think that the jaw crusher he had referred to was usually employed for the crushing of the clinker from rotary kilns. The great advantage of the rotary kiln was that one was able to watch the whole process of burning and control it accordingly, whereas with the old intermittent kilns, after the fire was lit, things had more or less to take their chance. Moreover, when it was desired to start the kilns again the chambers had to be allowed to cool down before the men could enter them. Mr. Boot was hardly correct in saying that only about 20 per cent of moisture was added to the materials with the vertical continuous type of kiln, because that amount of moisture would mean that the raw material would have to be dried before being put into the kiln, for he was sure that no

vertical kiln would burn material containing 20 per cent of moisture. He had also said that rotary kiln cement was nearly always specified for ferro-concrete, and would command a higher price than the kind burned in brick kilns; but while the rotary kiln cement might be a better controlled cement, there were in this country a great number of intermittent kilns turning out excellent material. Then, in dealing with the question of labour, Mr. Boot had stated that it was possible to run a cement works, having an output of from 2,000 to 3,000 tons a week, with a staff of only thirty men per shift, whereas for the same output with the chamber kilns that number of men would be necessary for working the kilns alone. His own experience had shown him that in the working of chamber kilns, instead of thirty men, it would be nearer a hundred, and that quite thirty men would be required to produce 1,000 tons a week. Reference had been made to the fact that rotary-kiln clinker took more power to grind than chamber-kiln clinker, and that reminded him of the unsuccessful attempts made in the early days to use the old machinery for the product of rotary kilns. Different machinery had to be designed, and the standard method of grinding clinker was now some modification of the ball and tube mill. He did not understand why the purchaser should be expected to pay more for rotary-kiln cement, because, although it cost more for grinding, less labour was required. In his silos Mr. Boot had allowed three or four weeks' output. That, he thought, was rather on the small side; it was more usual to allow for six weeks. The vacuum process of emptying silos had its disadvantages, he considered, though he did not think it had been much used in this country. The more usual method was the employment of conveyors running into the packing-house. With regard to the use of gypsum, he hoped Mr. Boot had arranged some mechanical method of adding this to the clinker. The amount of gypsum required to regulate the setting of cement varied from only ½ to 2 per cent, and where there was no regular method of doing the work uneven mixing could easily result. Mr. Boot had said that there were now several firms in this country who were able to build most excellent rotary kilns. He was glad of that, because until the last few years the Germans—and one Danish firm—had erected nearly all the plant of that kind in England.

Mr. A. PALMER (Greenwich), seconding the vote of thanks, asked what was the recognised chemical composition of cement, and the difference in time of manufacture between the old and the modern method.

Mr. W. WALLIN (Newcastle-on-Tyne) said it was probably true that, until they had heard Mr. Boot's paper, not 25 per cent of those present that day knew anything of the process cement went through in the course of manufacture. It naturally followed that the sites of works should be in the most advantageous positions. The cement industry had flourished in the North of England—on the Tyne, Tees and Humber, but the manufacture on the Tyne was almost impossible from the practical point of view, owing to cost of freight on raw materials. Mr. Boot considered cement a very cheap commodity, but there were many of them who regarded it as being very expensive. There was one point the paper had not touched upon—namely, the testing of cement. That was very important. It was very nice to see the makers' tests, but how many of them could get the same tests out in their own offices? The British Standard Specification, to which both manufacturers and engineers had to work to, had been of inestimable benefit; by adhering to that one knew that one could not go far wrong. All cement that went on to the works upon which he was engaged was tested, and if they did not get out the manufacturer's test, they always got above the British Standard Specification. They had also to think of the British working man, who was not always too careful, and they accordingly had to allow a big factor of safety, just as they did in any other class of work. It had been said that the cost of cement had been reduced since the introduction of rotary kilns. He did not think it had to the user; in fact, there had been a very large increase.

MR. CUTLER: What is the cost of production per ton at the works? (Laughter.)

THE PRESIDENT, in closing the discussion, observed that while one could rely on manufacturers turning out cement fit to use, in all works of any magnitude he always provided for cement to be tested by a recognised expert. The samples were always taken when the cement came to hand, and the results were available before it was required in the work.

The vote of thanks was carried.

Mr. BOOT, in reply, said he hoped he had brought out clearly the importance of the uniform mixing of cement. Where one had large clumps of clinker it was quite usual to break it up before grinding. Of course, in the case of rotary-burnt clinker the jaw crusher was not required. He was surprised that Mr. Butler considered the merits of rotary-burnt clinker cement and chamber-burnt clinker cement to be equal. He thought one of the conditions engineers required for reinforced-concrete work was that rotary-burnt clinker cement should be used, and not the chamber-burnt kind. With rotary-burnt clinker one was certain to get a good material, but it was not so with the other. He thought Mr. Butler would find that when tenders were invited for the carrying out of ferro-concrete work, rotary-burnt clinker cement was nearly always insisted upon. Mr. Butler did not see why more should be paid for the rotary-kiln than for the chamber-kiln cement, but the fact remained, as he could prove, that higher prices were being obtained. As an engineer designing works, he should like to be able to agree that a capacity of three or four weeks for the silos was insufficient; but one had to remember that the cost of the silos formed a very large proportion of the cost of the works; one had to fix a minimum, and decide upon something between that and what one would like to provide for. That was what they had done in their particular case, and the storage capacity they had arranged was certainly equal, if not above, the capacity of other plants in the country. The silos would store something like 10,000 tons of cement. In regard to unloading, in some works it was usual to have a hopper-bottom to the silos, but that increased the cost of the silo by about 33⅓ per cent, and it had been found, moreover, that with the ordinary hopper-bottom the cement arched badly, and had to be prodded constantly to make it flow properly. So it was a question whether the hopper-bottom design of silo for cement was altogether the best; in his opinion the best arrangement was probably some form of vacuum process for emptying, such as he had described. It had a great many advantages, one being that it made no dust whatever. There was another method, a portable screw conveyer, which was very largely used for grain, and was most successful, and he saw no reason why that should not be employed for cement. Special arrangements had been made for the mixing of gypsum with the clinker. Mr. Wallin was quite right in saying that many of the cement works in the North of England were either shut down or not working at their full capacity, but he thought he would find on inquiry that there were definite reasons for that. There were several cement mills being designed to-day in the North of England, not far from the Tyne. Mr. Cutler asked for the cost of production per ton. He would probably be able to give that when the works were running. (Laughter.)

Buckingham Rural Roads Upkeep.—A proposition "That the council employ no labour on the roads for the time being," which was partly discussed at the last meeting of the Buckingham Rural District Council, was finally considered in committee. It was eventually decided to retain four of the nineteen men employed on the roads -one for each of the four sub-districts.

Arbroath Public Baths.—Deducting sums, amounting to £7,600, received from Mr. Andrew Carnegie and Mr. Alexander Balfour, of Inchock, there was a deficiency of £1,019 upon the cost of Arbroath public baths, which were completed recently. At the town council meeting last week it was announced that Mr. Balfour had subscribed a further sum of 1,000 guineas, thus wiping off the deficiency.

Pile Drivers and Pumps.—A booklet illustrating the McKiernan-Terry patent hammers for pile driving has been issued by the British Steel Piling Company, Dock House, Billiter-street, London, E.C. These hammers are double acting. They can be operated with either steam or compressed air, and in changing from one power to the other no adjustment of any sort is necessary. We gather that no pile-driving frames are necessary with the small sizes, nor absolutely necessary with the heavy ones, and the hammers can be suspended -suspended from a crane, shear legs or scaffold pole, the motive power being led to the hammer by means of a flexible hose and couplings. The hammers rest on the pile all the time. Another booklet issued by the same firm illustrates the "Zenith" petrol motor-driven centrifugal dredge and water pumps.

Association of Managers of Sewage Disposal Works.

ANNUAL GENERAL MEETING IN LONDON.

As mentioned in these columns, two papers, "The Work Done at Salford by the Activated Sludge Process," by Mr. W. H. Duckworth, F.C.S., and "Recent Improvements in the Construction of Cultivation Tanks," by Mr. W. D. Scott-Moncrieff, M.I.MECH.E., F.R.S.I., past-president, were submitted at the recent annual general meeting of the Association of Managers of Sewage Disposal Works. Mr. Scott-Moncrieff's paper was reproduced in our issue of last week, and that of Mr. Duckworth will appear next week.

The President (Dr. Sidney Barwise), in opening the discussion, observed that what had struck him about the scheme described by Mr. Duckworth was, if it proved a commercial possibility, its immense advantage in districts where filtration involved pumping. If sewage could be purified without any [illegible] whatever, it would obviate the necessity of pumping the sewage on to the filters. Of course, pumping in the air involved a certain amount of motive power, but nothing like that required for sewage pumping. The scheme seemed to be elastic, but he should like to know the quantity of air introduced, for the cost would depend largely on that.

Lieut.-Colonel Jones, V.C.: As one who had always believed in aëration as being a very valuable element in sewage purification, he had listened to the paper with great interest, but he was not prepared to discuss the question to-day. Mr. Duckworth had placed the subject before them in a very clear manner. They all knew him (the speaker) as an advocate of land irrigation from the first; he had not given up that opinion, but it was laying by until Mr. Lloyd George got through his Bill to enable sanitary authorities to acquire land necessary for their purposes at a reasonable market rate. The war had thrown all these things into the shade, but he believed it would come in time, and that future generations would [illegible] to the very best artificial process. For years it had been impossible for any engineer to give a reliable estimate of the cost of the best plan for sewage disposal [illegible] acquiring the necessary land. It was the uncertainty as much as the cost which stood in the way of sanitary authorities adopting a land scheme, and it was everyone's object to do with as little land as possible. Now came the present experiments, and he hoped they would be completed with care and attention to detail, and have good results. But in the end he did not believe they would beat land treatment, for land questions would come to the front again after the war, because more food must be grown in this country.

Mr. J. B. Barford (Maidenhead) said two points in Mr. Duckworth's valuable paper would strike them all. They must have been impressed with the great difficulty which the Salford sewage presents, because of the large quantity of trade waste which had to be dealt with. Those difficulties had been tackled, and the results were eminently encouraging, not only in regard to domestic sewage, but also as to trade waste. The paper would encourage many managers to consider the scheme, because they were not all at work in manufacturing districts. Still, they had various kinds of sewage to deal with, and the River Boards watched them closely to see that they did purify the sewage, and it might be possible for them to adopt the Salford system. Hence the association would be grateful to Mr. Duckworth, and when the war was over they would probably hear more from him as to the difficulties he had had to encounter and the things that had held back the experiments.

Mr. W. D. Scott-Moncrieff said he thought the method described by Mr. Duckworth was a courageous effort to deal with sewage purification on [illegible] which, speaking with a good many years experience, he considered to be perfectly reasonable and coherent. What did occur in this treatment? They had the formation of a certain amount of sludge, which was due to changes which had occurred in the sewage as a result of the treatment. From a practical point of view, how must they regard that sludge? In the nature of things it was a food supply from a vast colonisation of micro-organisms, as all knew who were associated with the mineralisation of organic matter. The sludge containing this vast number of organisms was aerated, the effect of that brought certain obvious advantages: one that it broke up the organic matter. A great disadvantage of the colloidal condition was that the particles adhered, and there was therefore an unfavourable condition for treatment or contact with the organisms that did the work. Here the sludge was thrown into a flocculent condition, due to aëration. The disturbance due to the aëration allowed a survival of the aërobic organisms, and this was probably due to the presence of oxygen. The process was perfectly intelligible. Having got this favourable condition for further oxidisation, there came the practical question of how far this affected the total amount of residual sludge, which was always a standing difficulty; and the second point was whether the cost of producing this final purification was or was not prohibitive. They all knew the difficulty of making a fair estimate of the cost. The question was whether, after all, this process was not the long way round. In his own paper this matter was dealt with—the establishing of favourable conditions for the nitrifying organisms. They had had the startling results obtained from downward filtration, not with any particular sewage, but in general terms; these results were effected in a very short time—not nine hours or so, but in a few minutes. That fact had been confirmed by a wide experience, and he did not think, as practical men, they should overlook them. The results were obtained by the action of gravity, which cost nothing, and the method was efficient and extraordinarily rapid. But he did not wish them to ignore the importance of the Salford experiments, which he hoped would have every success, for they might well prove [illegible] of the city, so far as sewage treatment was concerned.

The President (Dr. Sidney Barwise) observed that in the *Canadian Engineer* there had appeared a diagram giving the cost of sludge treatment by a somewhat similar process to that tried at Salford. Mr. Scott-Moncrieff had referred to the question of cost, and the important point, as already stated, was whether the sewage of a district was high enough to go on the filters by gravitation. If sewage could be nitrified by pumping air through it, and the cost was less than pumping up the sewage, then there would be an advantage. But they had no figures as to the cost at present.

Dr. S. Rideal thought they ought to look at the paper from the point of view of the work that was meant to be done by the oxygen in the air. Years ago they learned from the Royal Commission on Sewage Disposal that sewage had to be purified from the suspended matter in it, and by the oxidisation of the effluent. Those were the two determining factors. The commission also showed that oxidisation could be effected either by means of land treatment, artificial filtration, or by the dilution method. Hence they had to consider how much oxygen was required to do the work. Oxygen existed in the air, in river water, in the land, and in filter-beds, and the problem was to find the best and cheapest way to introduce the oxygen to the sewage. Tables were given to show the volume of water to be allowed for the purification of sewage, provided the suspended matter was removed. Take crude sewage and mix it with 300 volumes of water—the Royal Commission figure—and the oxygen in the water was able to bring about sedimentation, and was capable of dealing with the sewage without any method of purification whatever, provided there were no solids in it. Replace the 300 volumes of river water with ten volumes of air, and it might have been possible for the commission to have said that crude sewage, after the removal of suspended matter, if mixed with ten volumes of air, would be sufficiently purified. From what they had seen, the activated sludge process brought about a remarkable removal of solids, and there was a sharp line of demarcation between solids and effluent. So that the process gave them a means of bringing the sludge into such a form that it could be dealt with by other means, and gave them an effluent sufficiently clarified to allow it to be mixed with a large volume of river water. The point to consider was how the oxygen of the air could be efficiently mixed with the sewage. If the oxygen really did oxidise the sewage, then the bubbles of gas that came from the activated sludge at the top of the tank ought to be entirely devoid of oxygen, and should be merely nitrogen. The air should be

blown through the sewage at such a rate that the whole of the oxygen was fixed or utilised. If not, and oxygen did escape, the method was not an economical one, for more air would be pumped in than was theoretically needed. This at once brought them to the vital question of cost. The problem was one which had to be very carefully considered as a whole before they could pass any final judgment on the process. He had not yet seen it, but he thought that the amount of oxygen introduced in this way in the form of air, and the amount given by the Royal Commission in river water, would be interesting.

Mr. W. MAKEPEACE (Stoke-on-Trent) paid a tribute to the active work for the association, carried out for so long, by Colonel Jones, Mr. Scott-Moncrieff, and Dr. Rideal, and suggested that the Salford process was really a new feature of an old proposal. The results obtained were certainly encouraging to those engaged in the work of sewage disposal. It had been developed very much by Mr. Ardern and Mr. Lockett, and he thought it was distinctly a move in the right direction. He believed eventually it would be proved to be not only an efficient method, but also an economical one as soon as they got over certain little mechanical details which at this stage were against development. He thought, too, that it answered the problem of speeding up bacteria beds. According to Mr. Scott-Moncrieff, once gravitation was started it cost nothing; the same thing could be said of the air, as soon as it was released at the bottom of the tank it cost nothing to pass through the sewage. Under all the circumstances he was hopeful, and fairly confident, that they would be shortly making a distinct advance in the method of final purification of sewage by bacterial means.

Mr. P. GAUNT (Macclesfield) thought the question of temperature would prove of some importance. Mr. Duckworth's record of 51 deg. was exceptional; his own temperature was nearer to 44 or 45 deg. It was possible, too, that there was a waste of air, and no statement had been given them as to the actual quantities used. He did not think that, as a chemist, Dr. Rideal would expect any process to be quite so complete as he suggested in his concluding remarks.

Mr. J. LAMB (Worcester) emphasised the importance of the results obtained in the continuous process, a matter which was of special interest in his own district in view of the plant now being put down.

The PRESIDENT (Dr. Sidney Barwise) said that the activated sludge process was the biggest movement they had had since percolating filters knocked contact beds out. Mr. Duckworth would probably tell them that he had not measured the quantity of air introduced, and doubtless it was an unnecessarily large amount. As Dr. Rideal had pointed out, there was the theoretical amount of oxygen, but they also wanted the mechanical effect of stirring up. One thing he could never understand was how the Royal Commission came to the conclusion that there was no river in England long enough to effect its own purification. That had stopped experiments in this country for twenty years. He tendered the thanks of the meeting to the readers of the papers.

Mr. DUCKWORTH, in acknowledgment, explained that at Salford they had not measured the quantity of air used, but they were putting in meters. Later on they would know exactly what they were using. The experiments were being carried on with the object of proving both systems. It had been thought at first that a continuous flow was impossible of achievement, but they had been dealing, as he had explained, with from 30,000 to 60,000 gallons, with a daily capacity of 18,000. No doubt they were still a long way from doing all that was necessary or possible. They had not yet tried revolving arms, and it was to be remembered that the plant they were using was designed for other work than that to which it was being put. The lowest temperature recorded was 51 deg., and the results had been very good during January to April, when the weather could be expected to be severe. They had reduced the blowing in the fill and draw tank from three to two hours, and from two to one and a-half. Personally, he regarded the activated sludge process as the most hopeful thing in the sewage line. He could not deal with Dr. Rideal's question as to the air bubbles; to him that point seemed more academic than practical. All the facts suggested that they could reduce the air largely and still get reliable results. They had not yet touched the sludge problem; he was not a farmer, but in an experiment with potatoes he got, with horse manure 34 lb., and with activated sludge 74 lb.

Mr. SCOTT-MONCRIEFF also replied briefly to some of the points raised.

INSTITUTION OF WATER ENGINEERS.

WINTER GENERAL MEETING IN LONDON.

The twentieth winter general meeting of the Institution of Water Engineers was held at the apartments of the Geological Society, Burlington House, W., on Saturday last. Mr. Fredk. Wm. McCullough (Belfast), the president, was in the chair, and there were also present Messrs. H. C. Adams (London), H. W. Apted (Richmond), T. Ball (Snodland), A. B. E. Blackburn (Sunderland), W. T. Burgess (London), G. F. Carter (Croydon), S. C. Chapman (Torquay) W. Clemence (Walton-on-Thames), A. H. Cooper (Wey Valley) J. Dewhirst (Chelmsford), F. Dixon (Ashton-under-Lyne), G. T. Edwards (Leicester), P. Griffith (Westminster), secretary, H. C. Head (Winchester), H. Ashton Hill (South Staffordshire), W. Jenkins (London), D. Kitchingman (Southampton), H. Lapworth (Westminster), E. A. Lees (Birmingham), W. Matthews (Westminster), T. Molyneux (Stockport), C. B. Newton (Hull), C. W. S. Oldham (Ipswich), A. W. Oke (Southampton), J. S. Pickering (Cheltenham), H. Preston (Grantham), C. H. Priestley (Cardiff), C. Clemesha Smith (Wakefield), T. M. Thomson (Tonbridge), A. C. Walker (Reigate), and W. Whitaker (London).

Mr. PERCY GRIFFITH, secretary, read the minutes of the ordinary summer meeting, held in London, and they were confirmed.

The PRESIDENT expressed his pleasure at seeing so large an attendance, in view of the existing conditions, and said that no doubt the reason why it was not larger was that many members were serving with the Forces.

Messrs. G. T. Edwards and W. R. Jenkins were elected scrutineers of the ballot for the election of the council for the year 1916-17.

The result of the ballot was announced as follows:—

President: Mr. F. W. McCullough (Belfast).

Vice-presidents: Messrs. A. B. E. Blackburn (Sunderland) and S. C. Chapman (Torquay).

Ordinary Members of Council: Messrs. J. C. Barrowclough (Batley), F. J. Dixon (Ashton-under-Lyne), H. C. Head (Winchester), C. B. Newton (Hull), H. Preston (Grantham), C. H. Priestley (Cardiff), C. H. Roberts (Aberdeen), E. J. Silcock (Leeds and Westminster), H. W. Woodall (Bournemouth), and W. Matthews (Westminster).

Subsequently, on the motion of Mr. BLACKBURN, seconded by Mr. PRIESTLEY, a vote of thanks was passed to the scrutineers.

The PRESIDENT, on behalf of the council, moved: "That Messrs. Wood, Drew & Co. be and are hereby appointed auditors to the institution for the year 1916 at a fee of five guineas, and that Messrs. Arthur Valon and William James Eames Binnie, B.A.CANTAB., be and are hereby elected honorary auditors to the institution for the same period."

Mr. A. B. E. BLACKBURN seconded the motion, and it was carried.

A paper entitled "Notes on the Definition of the term 'Domestic Purposes' in General and Private Water Acts," which is reproduced on another page of this issue, was afterwards submitted by Messrs. A. B. E. Blackburn (Sunderland) and Percy Griffith (Westminster).

Northampton Polytechnic Institute.—The annual prize distribution will take place to-morrow (Saturday) afternoon.

Salt for Clearing Snow.—During the last two years the work of clearing the streets of Birmingham after a snowstorm has been facilitated by the use of salt, and the public works department of the corporation have arranged to adopt similar measures this season.

Portable Water Sterilisers.—We have received from the Lawrence Patent Water Softener and Steriliser Company, Limited, Parliament Mansions, London, S.W., particulars of "The Warden" portable water steriliser, an apparatus by which it is possible to obtain, without storage being required for the treatment, 30 gallons of sterilised and palatable water per hour. The apparatus is automatic in action and self-contained, and can be quickly got into operation and stopped, without time being taken up in assembling or disconnecting parts. It also provides for a supply of hot sterilised water if required. The apparatus occupies only a small space, about 18 in. by 12 in. by 3 ft. high. It is intended primarily for the use of troops in the field, but it should be of the greatest value to contractors abroad carrying out operations over extensive distances in unpopulated country, and for expeditions, or in temporary concentration camps.

CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.

OLD STUDENTS' SOCIETY: PRESIDENTIAL ADDRESS.

An interesting address was delivered yesterday by Mr. Henry Charles Adams, M.INST.C.E., M.I.MECH.E., on assuming the duties of president of the Crystal Palace Old Students' Society, the occasion being the annual meeting of that body.

After returning thanks for his election, Mr. ADAMS said:

The Crystal Palace School of Practical Engineering is an honoured name, and we all look back with pleasure on the years we spent, so profitably under the shadow of the "South Tower." From the announcements that have been made, and from the rumours that have been afloat, you will not be surprised to hear that some fundamental changes are to be made in the relations of the Engineering School to the Crystal Palace trustees, who are the successors of the old Crystal Palace Company. It is inconceivable that after an honourable life of forty-two years such a vigorous, useful and self-supporting institution should be allowed to cease its existence, and it is therefore with the greatest relief and pleasure that we learn that Mr. J. W. Wilson has arranged to continue the school upon his own responsibility. Under the sole control of such an experienced engineer and eminent teacher, we have every confidence that the school will not only maintain, but increase its already high reputation. When it is borne in mind that considerably more than 2,000 students have received some part of their training in the Crystal Palace School of Practical Engineering it will be apparent how great an influence Mr. J. W. Wilson and Mr. Maurice Wilson, and their father before them, have had in guiding the current of engineering practice, not only of this country, but of the whole world. It is consequently a matter of considerable gratification to us personally, and it should be of interest to the public generally, to learn that, notwithstanding the vicissitudes through which the Crystal Palace has passed, there is no intention and no probability of the Engineering School being brought to an abrupt termination, whatever may happen to the Palace itself.

As affording opportunity and place for meeting after leaving the school, our society has played a useful part during the twenty-one years it has been established. Owing to the present national conditions, the fact of our having reached our "majority" has not been celebrated in the manner we would otherwise have liked, and for the same reason the council have determined to abandon the usual annual dinner and other social functions.

VALUE OF ENGINEERING KNOWLEDGE.

Although membership of the society is only open to old students of the Engineering School, we do not claim to be an engineering society, or perhaps I should say a society of engineers, because, for one thing, some of our members are following commercial careers; while, for another, we meet for social intercourse rather than to discuss professional topics. The success which our former colleagues have achieved in the commercial world lead one to consider the extent to which it may be due to their engineering training; and, further, whether a partial engineering training would not be beneficial to all men, no matter what occupation they may propose to follow up.

Every convenience, necessity or luxury of the present day bears the imprint of the engineer on its design, or necessitates the services of the engineer in its construction or manufacture, or in the means which have made its production possible. Brought thus into intimate touch with engineering matters from the cradle to the grave, it follows that a man with even a slight knowledge of the practice is better able to understand what he sees, and is more competent to judge the merits of any project that may be put before him. The effects of a scientific training go deeper than this, however. With all respect for the advantages derived by the standardisation of details, the individual learns that indiscriminate copying must be avoided, and that merely because a scheme or a design is successful in one place, there is no assurance it will be successful in another where the circumstances and conditions are different. He finds that there may be half-a-dozen solutions of a given problem, and his training will guide him to the proper selection. The importance of accuracy and attention to the minutest detail will be ingrained in his mind. He will have a good perception of what is essential and what superfluous, and will realise that, however alluring a project may appear, it will be futile unless founded on the immutable laws of science. Other points might be mentioned, but probably sufficient has been said to show that there are general commercial advantages to be derived by undergoing a course of scientific training.

ENGINEERS AND THE WAR.

It will be seen from our annual report that some 200 old students are known to have joined His Majesty's Forces. As it has not been possible to keep in touch with more than half of those who have passed through the school, it is probable that the number is actually much greater. Many of the older students have, however, passed the limit of age when they can render service in the fighting line, and it is to be regretted that the Government has not seen its way to have organised a more general use in a professional capacity of the senior members of the civil engineering profession. A few favoured or fortunate individuals have been retained to design and carry out constructive works, but the vast majority of civil engineers in private practice, and architects as well, have been hardly hit by the war. It is said that professional services have been offered gratuitously by a sufficient number of engineers to cope with all the Government work there is to do. If this is so, it is rather surprising, because practising engineers as a body are not usually thought to be so wealthy that they can afford to work for nothing. There are many who, if they were given the opportunity, would willingly undertake work at a modest remuneration, rather than be idle as they are at present. It is a curious commentary on the organisation of the country that wholesome men, not necessarily engineers, are making so much money that the spending of it is causing serious misgiving to the Government, there are others whose earnings are reduced to such an extent that, to say the least, they are prevented from bearing their full share of the financial burdens which have been, and will be, laid upon the country.

With new towns, in the form of military camps, springing up all over the country, there must be much work of the character usually designated as municipal and sanitary which has devolved upon the officers of the Royal Engineers, and, to a lesser extent perhaps, on those of the Royal Army Medical Corps. Considering the limited extent to which their ordinary training would qualify them to act as experts in these matters they have, on the whole, met the difficulties in a creditable manner. It is probable that these particular duties could be carried out equally well, if not better, by engineers trained in civil walks of life, and the employment of such men would enable the military officers to give greater attention to the military duties which they are so well qualified to perform. However, when regard is had to the wonderful achievements of the Government, and its administrative and executive staff, in raising and equipping armies and carrying on the war on a scale far beyond what had ever been contemplated, the fact that improvement is possible in some features need cause us no misgiving, and we can look forward with every confidence to a successful issue, and a future of peace and prosperity for our country and ourselves.

Mr. Percy Griffith, M.INST.C.E., will on Wednesday next distribute the prizes, &c., to the students of the Crystal Palace School of Practical Engineering.

Miss Marie Corelli and the Lamp-post.—The Highway Committee of the Totnes Town Council reported on Tuesday that Miss Marie Corelli had sent £8 15s. 6d. in settlement of the council's claim for a lamp-post knocked down by her motor car. Alderman Hayman said Miss Corelli intimated in her letter that she had provided the town with a modern lamp-post instead of an old-fashioned one. Perhaps it would be well if the council sent her the old one as a memento or curiosity. (Laughter.) No doubt it would be of great interest to her.

Redditch Electricity Undertaking.—At a meeting of the Redditch Urban District Council held recently, a resolution was passed approving of the borrowing of a further sum of £12,542 in connection with the reconstruction of the town's electricity undertaking. The original estimate of the cost of the scheme was about £28,000, towards which a sum of £25,000 has been borrowed. The further loan of £12,542 now approved brings the total cost to £38,127. Application is to be made to the Local Government Board for sanction of the new loan.

Arterial Roads in Greater London.*

By W. R. DAVIDGE, ASSOC.M.INST.C.E., A.R.I.B.A., District Surveyor for Lewisham.

For something like seventy years no main roads of importance, beyond estate roads, have been constructed in Greater London. The population has grown sevenfold, but the main roads remain the same as in 1830; in fact, in many places they have been encroached upon by projecting shops and everywhere encumbered by standing vehicles.

Since the formation of the London County Council there have been many important street improvements, and the total street improvements of the century have been very remarkable; but these only emphasise the need for planning and improving the roads when yet it is open country.

THE RESUSCITATION OF THE ROAD.

With the advent of the motor car and motor lorry, the general surfacing of the roads has immeasurably improved, but the proposals of the London traffic branch of the Board of Trade are the first real steps to a much-belated reform of the arterial roads in Greater London.

One might wish that Colonel Hellard had been blessed with the opportunities possessed by his predecessors in 1830, the commissioners of metropolitan roads; but the mischief has already been largely done, and it is indeed a source of congratulation that he has been able to evolve such a splendid series of routes wherewith to supplement and improve the all too inadequate channels by which road traffic enters and leaves the London area.

It is a merciful providence too that, after endless conferences with the representatives of local authorities and professional and other societies, the original proposals of the London traffic branch of the Board of Trade should have emerged without serious mutilation.

Many of us would prefer that such a matter should be left to the wise discretion of one or more expert commissioners such as Colonel Hellard, rather than to the tender mercies of councillors, whose local knowledge is very valuable, but who may be, and often are, swayed by local or parochial considerations only.

It is a tribute both to the excellence of the suggestions and to the tact of those in charge of the conferences that they should have been so well received, and it is to be hoped that the next step, the construction and finance of the proposals, will be equally well received.

THE PRESENT NEEDS.

The traffic of Greater London has for the last century or so followed certain definite channels, and it is not by any means an easy task to lay down new lines for such traffic to follow. The lines may be made, but for the traffic to use them requires first of all that the new route shall be shorter or easier than the old.

The old routes, however, are not always bad. They are frequently narrow in the old village high streets, but as a rule they follow the valley lines or lines of least resistance, and any departure from such lines, except in the way of short cuts, rounding off corners, and so on, is almost bound to involve either a longer distance or more difficult grades than the older route.

Here and there, it is true, a new line altogether can be mapped out, such as the proposed Western-avenue, the new Cambridge-road, or the Eastern-avenue, but the little hamlets and villages on its route seem to this generation hardly sufficient to make the road worth while.

These entirely new routes, however, are those which possess the greater hope for Greater London. The older routes are all, without exception, narrow or congested at some one or more points just outside London, such as the narrow high street of Brentford, Croydon, Bromley, and so on, and, although by-pass roads may lessen this congestion, they cannot altogether remove it.

In these virgin areas, however, there is a great opportunity of giving London egress to the country. If this is to be the ideal though, such new main roads must be designed, not with the notion of developing these vacant areas and turning these too into wildernesses of bricks and mortar, but to give direct and speedy access to the country beyond. It would be infinitely better if these vacant spaces could be left as long oases of open country.

Failing this, however, the fewer the cross roads the faster will be the speed possible, and whatever development is permitted the road functions with the new main artery should not be sudden entrances at right angles, but arranged in such a manner as to give ample warning. This is probably best obtained by the old system of roadside wastes and subsidiary or side roads where such functions occur. There are local authorities in Greater London whose by-laws require cross roads to be inserted at least every 200 yds., but on arterial roads of this description every cross road acts as a check on the speed, and at the same time adds to the danger.

The requirements of a main road are approaching more and more nearly to a railroad track, and if not entirely separate tracks, they must, at any rate, be protected by a strip of grass or low shrubs from the traffic coming from cross roads.

THE BOARD OF TRADE PROPOSALS.

Everyone who has investigated these routes on the ground, and tried to find an alternative route, must appreciate the skill and thoroughness which has been shown in their selection, and rarely indeed can there be any difference of opinion as to the general desirability, and in many cases absolute necessity, of the routes suggested.

If the proposals have erred, it has been in providing for the needs of the present more than for the future, and any criticism must be directed, if possible, to extending and multiplying the admirable routes chosen by Colonel Hellard.

The conferences, too, arranged by the Local Government Board between the local authorities and representatives of professional and other societies have been remarkable for their unanimity of opinion on the necessity of the task on which they were engaged.

Some quibbling, indeed, there was at first as to who should be saddled with the cost, but so far this consideration has vanished to the background, the only question being as to the suitability and desirability of the route itself.

Many investigations have been made on the spot, and in some cases the routes have been modified. Substantially, however, they are those originally fixed by the London traffic branch of the Board of Trade.

The sectional conferences have not yet submitted their conclusions to the main conference, but the preliminary reports already published indicate the following findings:—

That there is a general consensus of opinion in favour of the principal road proposals of the London traffic branch of the Board of Trade.

That the existing main roads are in hardly any case adequate for probable future traffic, and are in many instances of insufficient width for present needs.

That the by-law width of 40 ft. (or some cases 50 ft.) is too narrow for main roads.

That town planning schemes would be of great assistance in the provision of better roads.

The roads considered have been classified by the conferences as (1) necessary roads, (2) very desirable roads, (3) suggested roads.

In most cases only those coming under the heading of "necessary roads" have so far been investigated. The work of the conference has, like everything else, been injuriously affected by the war, but it was decided that the proper course was to continue the work in order that at the end of the war everything should be ready to put the work actually into execution, and thus provide, when available, an outlet for the labour of large bodies of men.

The recommended roads may be summarised as a north and south circular road, a new main road westwards, a new main road eastwards, and a new main road northwards. By-passes at Brentford and Croydon are already arranged for. Other by-passes are proposed to avoid Romford, East Ham, Sutton, Kingston, and Kingston Hill.

THE FUTURE NEEDS.

Town planning schemes can and must reserve these routes wherever they pass through open country. The local authorities will, no doubt, realise the necessity for this course, but should any of them not do so, or should building be allowed to proceed across the line of route, it is evident that the whole of time and thought expended in the conferences may be futile.

*From a paper read on Friday last at a Meeting of the Town Planning Institute

The Surveyor
And Municipal and County Engineer.

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It is therefore essential that the Local Government Board should itself accept the responsibility for seeing that these routes are reserved, and the present law is, or should be, sufficient for this purpose.

With the proposed new thoroughfares in the built-up area the case is very different, and special legislation will, of course, be needed to preserve the routes from fresh building operations and to secure them for public use when needed. What form this legislation should take is an open question, but the Government owe it to our large towns that some extension should be made into the built-up areas of the principles of the Town Planning Act.

Very important, too, is the necessity for some power to prescribe building lines, both on existing streets and new streets, and also possibly on the lines of proposed improvements.

At present building lines can only be "defined" within the county of London for lengths of streets where buildings actually exist, and outside the county, under the Public Health (Buildings in Streets) Act, 1888, the permission of the local authority is necessary whenever buildings are to be brought in front of the adjoining buildings.

Where there are no buildings, though, the first builder on the scene can, in the absence of a town planning scheme, create his own building line. He can build right up to the road if he wishes, without let or hindrance, irrespective of the fact that the road badly wants widening. Some attempt has been made by valiant local authorities to persuade the builder to set back, but if they want the land for street widening they may at present have to pay for it at an inflated valuation.

To deal with this difficulty it has been suggested that the powers possessed by the metropolitan borough councils, within the county of London, of acquiring land for street improvement by simple resolution, under Michael Angelo Taylor's Act of 1817, might be extended generally.

Some action will, under any circumstances, have to be taken at the final meeting of the conference on arterial roads to secure that these matters are dealt with without delay. The present, when all building work is stopped, affords a unique opportunity to preserve these selected routes for new arterial roads, and it is to be hoped that the Local Government Board will at the same time see that some intelligent foresight is bestowed on the future development and extension of our arterial roads.

DISCUSSION OF MR. DAVIDGE'S PAPER.

Mr. Raymond Unwin, president, occupied the chair at the meeting of the Town Planning Institute at which the foregoing paper was read.

Colonel HELLARD (London Traffic Branch of the Board of Trade), in proposing a vote of thanks to Mr. Davidge for his paper, said he was glad to find it recognised that the arrangement of roads proposed by the Board of Trade was only what was considered absolutely necessary after a study of the existing roads and the traffic on them.

Mr. C. J. JENKIN, engineer and surveyor to the Finchley Urban District Council, seconding the vote of thanks, agreed that it was most important that these arterial roads should be proceeded with while the ground was fallow.

Mr. A. CROW remarked that what they all felt was that the one object they must have in view was the securing to London the possibility of making the roads when the time came that it was within the range of practical politics. Colonel Hellard could have told them of dozens of instances where the roads suggested by the Board of Trade, and more or less approved by the local authorities, were menaced by the development of building estates, and unless local authorities were prepared to enter into and seek permission to prepare schemes, he feared there would be no possibility in the future of carrying out, except at greatly increased expense, the suggestions that had been approved.

Mr. H. R. ALDRIDGE, alluding to the observations of the last speaker, said the moral was clear; in order to deal with the problem throughout the country they must have some measure of obligatory town planning. He supposed, however, that would require a large amount of education. The Local Government Board had a certain power to require local authorities to prepare schemes, and it seemed to him essential that those of them who were keenly interested in town planning as distinct from arterial roads should begin to use all the influence they could bring to bear on those authorities in the Greater London area to press them forward in the direction of town planning. It might be said that the present was not an opportune time, and that local authorities had no energy and hardly any staffs available for the work. He dissented from that view altogether. Local authorities, admittedly, were working with relatively small staffs, but although that argument might be valid in regard to many things that were non-essential, this was an essential thing, and one of the very first importance, and any hope of doing the work properly was absolutely bound up with the preparation of town planning schemes.

Mr. E. WILLIS, engineer and surveyor to the Chiswick Urban District Council, said he should like to support Mr. Aldridge in his proposal for obligatory town planning, though not necessarily on the lines of the present Act. The great point was that of finance, but we had now got accustomed to thinking in hundreds of millions, and it seemed to him the time had come when the fact must be appreciated that the country must consider its main routes, and that the local authorities should not have vast expenditures thrown upon them for improvements. Those main routes undoubtedly served the whole country, and in many cases by doing that the amenities of a neighbourhood were not improved. Therefore, why should a local authority be compelled to pay towards the carrying out of what was a distinct detriment to their neighbourhood?

Mr. G. L. PEPLER (town planning inspector, Local Government Board) observed that until the local authorities said what they were prepared to do the Government were unlikely to move.

The PRESIDENT suggested that if it were possible to express in graphic form the waste of time and money that was going on in London from the want of arterial roads they would have an argument which would tell with the public and help to convince the authorities that what they asked was not a reckless expenditure of public money, but an economical saving of public waste.

The vote of thanks was carried, and Mr. DAVIDGE made a short reply. The point, he remarked, was how they were to secure these arterial roads. It was a matter of immediate and practical politics, and one which would have to be settled at the next conference; and he hoped that all who went to that conference would go with a determination to see that their labours were not wasted, and that the powers that be took the necessary steps to see that these proposals were carried out.

Burton-on-Trent Electricity Undertaking.—The electrical engineer of Burton-on-Trent reports that, in order to safeguard the general supply of electricity, it will be absolutely necessary that new cables should be put in, as the old ones were becoming overloaded through the pressure emanating from the munition works. The town council, in the circumstances, have decided to make application to the Local Government Board for a loan of £3,500 for the work to be carried out.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

517. Venturi Meter.—Describe, with sketch, the construction of the Venturi meter, and explain the hydraulic principles on which it is based. ("Hydraulics.")

518. Strength of Materials.—Explain clearly the meaning of the terms (*a*) stress, (*b*) strain, (*c*) modulus of elasticity. What is the relation between them?

519. Mechanics.—Define the terms "force" and "work done by a force." What are the units of force and work as adopted by engineers in this country? State the relations between the gravitation and absolute units of force and work, and say why the latter units are so desirable for many scientific purposes. ("Student.")

520. Properties of Materials.—Compare the properties of wood and steel as regards the use of these materials for beams. (T. R.)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

516. Beams.—Show how to determine the bending moment and shearing force at any point of a beam which is continuous over three supports and carries a uniformly distributed load.

A continuous beam over three supports uniformly loaded is shown in Fig. 1. Equal spans $l=30'$; W = 15 tons; $p=\frac{1}{2}$ ton per foot. A uniformly loaded beam with a central support placed underneath it will, when deflected, assume a form similar to that shown in Fig. 2. Portions AD and EB will be curved downward, and portion DE over the central support will be curved upward, the upper edge in the latter case being convex and the lower edge concave; at the two sections of the beam D and E where the convex meets the concave there will be no curvature. These are termed the "sections of contrary flexure," or "points of inflexion." The beam may therefore be considered to be made up of three separate and independent beams—viz., AD, DE, EB. AD and EB are supported at their extremities, and DE is supported in the middle in the form of a double cantilever. The bending moments throughout AD and EB are positive, and those in DE are negative. At the points of "contrary flexure" D and E there are no bending moments, there being only shearing actions at these sections. The beam being uniformly loaded, the reactions at the abutments A and B will be equal to one-half the loads on AD and EB respectively, and the reaction at the central support C will be equal to the load on DE plus one-half the loads on AD and EB.

Continuous beam, uniform section, two equal spans, each loaded uniformly throughout its entire length—

Let AC = CB = l

p = load per unit of length on AC

p_1 = load per unit of length on CB

P, R, Q = reactions at the three points A, C, B respectively.

Taking moments about C we get

$$Pl - pl \times \frac{l}{2} = Ql - p_1 l \times \frac{l}{2}$$

also $P + R + Q = (p + p_1)l$

It may be shown from these and other relationships that

$$P = \frac{7p - p_1}{16} l$$

$$Q = \frac{7p_1 - p}{16} l$$

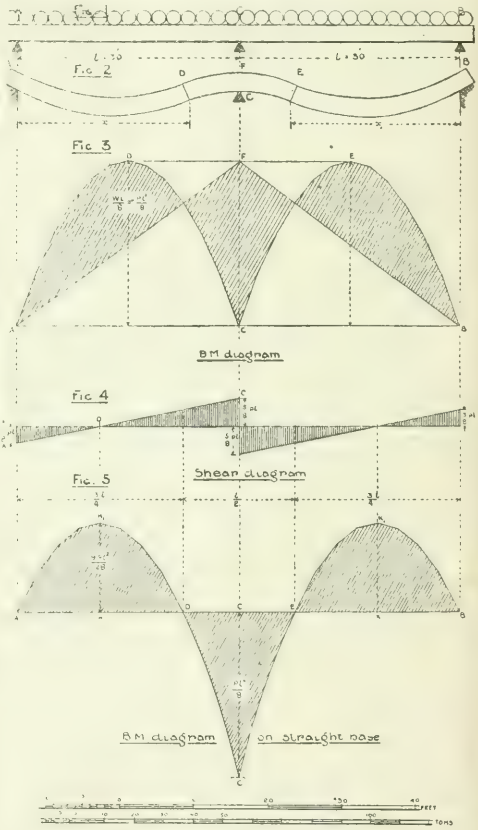
$$R = \frac{1}{8}(p + p_1)l$$

When the intensity of load on both the spans are the same—as in the present case—we have $p = p_1$, and the supporting forces become—

$$P = Q = \frac{3}{8}pl$$

$$R = \frac{5}{4}pl$$

When the reactions at the different points of support of a continuous beam are known, we can easily determine the points of "contrary flexure"—



Let AC = CB = l

P = distributed load per unit of length in AC

P_1 = distributed load per unit of length in CB

P, R, Q = reactions at the points of support, A, C, B respectively

x and x_1 = horizontal distance of the "points of inflexion," D, E, from A and B respectively.

Then, since P = half the load on AD

$$P = \frac{px}{2} \text{ or } x = \frac{2P}{p}$$

similarly $x_1 = \frac{2Q}{p}$

Substituting the values of P and Q as above we get

$$x = \frac{7p - p_1}{8p} l$$

$$x_1 = \frac{7p_1 - p}{8p_1} l$$

In our present case $p = p_1$

$$\therefore x = x_1 = \frac{3}{4}l$$

We have, therefore, this general rule—that in continuous beams of uniform section of two equal

spans and uniformly loaded, the distance of each point of "inflexion" from the near abutment is equal to three-quarters of the span; or the distance from the central support is equal to one-quarter of the span.

Bending moments on a continuous beam of two equal spans and of uniform section—

There are three maximum bending moments on the beam occurring at the centres of AD and EB and at C (Fig. 3).

Let M_b = bending moment at centre of AD
M_b = bending moment at centre of EB
M_c = bending moment at C

AD and EB are uniformly loaded with p and p_1 respectively.

The arm DC of the cantilever is loaded with $\frac{p_1 l}{2}$ at its extremity, and $p_1(l - x_1)$ distributed over it. The arm CE is loaded with $\frac{p_1 l}{2}$ at its extremity, and $p_1(l - x_1)$ distributed over it. We have therefore as the values of the maximum bending moment—

$$+ M_b = \frac{px^2}{8}$$

$$+ M_b = \frac{p_1 x_1^2}{8}$$

$$- M_c = \frac{p_1 l}{2}(l - x_1) + \frac{p_1 (l - x_1)^2}{2} = \frac{p_1 l (l - x_1)}{2}$$

$$\text{also} - M_c = \frac{p_1 l^2}{2} - \frac{p_1 l x_1}{2}$$

Substituting the values of $x x_1$ given above, we get bending moment in terms of p p_1 and l.

If, as in our present case, $p = p_1$, then $x = x_1 = \frac{3}{4}l$.

Substituting these values—

$$M_b = \frac{9pl^2}{128}$$

$$M_B = \frac{9p_1 l^2}{128}$$

$$- M_c = \frac{pl^2}{8}$$

Therefore, in a continuous beam of two equal spans, uniformly loaded, the maximum bending moment occurs over the central support, and it is greater than the maximum bending moment of the two spans in the proportion of 16 to 9.

To construct the diagram of moments (Fig. 5)—

Draw AB = $2l$

AD = $\frac{3}{4}l$, DE = $\frac{1}{2}l$, EB = $\frac{3}{4}l$

H C K are the centres of AD, DE, EB respectively. Draw HH$_1$ and KK$_1$ vertically upward and equal $\frac{9p_1 l^2}{128}$ on a scale of moments and construct the parabolic curves AH$_1$ and EK$_1$B; the ordinates of these curves will represent the moments at the corresponding points of AD and EB, and are all positive. Next draw CC$_1$ vertically downward, making it equal $\frac{pl^2}{8}$ on the same scale of moments. Draw the curves DC$_1$ and EC$_1$; the figure DC$_1$E represents the diagram of moments for the portion DE of the beam.

Shearing diagram (Fig. 4)—

Draw A A$_1$ = $\frac{pl}{2} = \frac{1}{4}\frac{pl}{2} = \frac{3}{8}pl$

and draw A$_1$C through D

(E. W. P., *Southampton*.)

In this case it is assumed that the three supports are at the same level; then Clayperon's Theorem of Three Moments states that—

$$M_a l_1 + 2M_b(l_1 + l_2) + M_c l_2 = \tfrac{1}{4}(w_1 l_1^3 + w_2 l_2^3)$$

where M_a, M_b, and M_c = bending moments at A, B and C and l_1 and l_2 = the distance between the supports and w_1 and w_2 = loads per foot run.

For simplicity let the intermediate support be placed midway between the end supports; then $l_1 = l_2 = l$ say, and the load is uniform throughout and equal w say; then the above formula becomes

$$M_a l + 2M_b 2l + M_c l = \frac{w}{4}2l^3$$

Since the ends of the beam are freely supported at A and C, the bending moments at A and C are zero—*i.e.*,

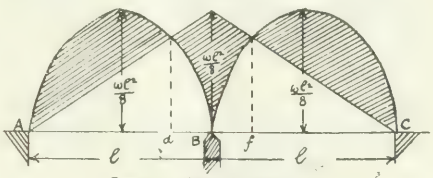
$$M_a = M_c = 0$$

So the formula further reduces to

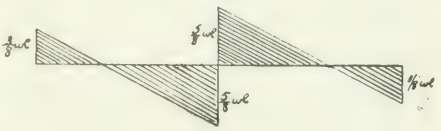
$$2M_b 2l = \frac{w}{4}2l^3$$

$$\therefore M_b = \frac{wl^2}{8}$$

The bending moment diagram may be conveniently drawn by drawing parabolas of maximum ordinate $\frac{wl^2}{8}$ on each span, and erecting an ordinate $\frac{wl^2}{8}$ at B and joining up by straight lines. The bending moment at any point is given by the ordinate, directly above the



Bending Moment Diagram.



Shear Diagram.

point in the shaded area shown in figure. The projections of the points where the straight lines meet the parabolas are *points of contra flexure*, d and f.

$$\text{Reaction at C} = \text{reaction at A} = \frac{wl}{2} - \frac{M_b}{l}$$

$$= \frac{wl}{2} - \frac{wl^2}{8l} = \tfrac{3}{8}wl$$

$$\text{reaction at B} = wl + \frac{2M_b}{l} = wl + \frac{2wl^2}{8l} = \tfrac{5}{4}wl$$

The shearing force diagram may be easily drawn by setting up $\frac{3}{8}wl$ at A, and decreasing the ordinates by an amount wl to $-\frac{5}{8}wl$ at B, increasing these by $\frac{3}{8}wl$ and so on, as shown in figure.

This is the simplest possible case of a continuous beam that could happen; a more general case of uniform loading over unequal spans is given in reply to question No. 833, Theory of Beams, in the "Assistants' and Students' Section," p. 147, July 30, 1915. (J. G. W., *Downpatrick*.)

Repayment of Loans.—Taunton Town Council on Tuesday passed a resolution urging the Local Government Board to issue an Order suspending for one year the annual payments to the sinking funds for the repayment of loans by local authorities, or in the alternative to sanction in all cases of loans repayable by sinking funds an extension of the period of repayment by one year. It was also decided to forward a copy of the resolution to the Association of Municipal Corporations, with a request for their support.

Tarvia.—Messrs. Bristowe & Co., Limited, of Tothill-street, Westminster, have issued an exceedingly clever Christmas greeting card, designed in black and white by J. Dudley Forsyth. It introduces, in an office interior, two well-known members of the firm, Messrs. Bristowe and Parker, whose unmistakable likenesses and characteristic expressions have been admirably depicted. Apparently they are drinking to a congenial toast from half-filled tumblers of "Tarvia," mixed with something from a syphon—an artistic licence which, we take it, is not to be accepted as bald fact, but as emblematical of that unlimited faith in the admitted virtues of "Tarvia," which have assisted them to market it with such wide success. "Here's to it," we may add—in printer's ink. To Messrs. Bristowe we are also indebted for a most practical telephone accessory, which includes a renewable pad for memoranda and provision for an alphabetical index of firms frequently communicated with. It is handsomely bound in red.

THE DISPOSAL OF SEWAGE BY DILUTION.

DISCUSSION OF DR. ADENEY'S PAPER.

In our issue of last week we reproduced a paper, "The Disposal of Sewage by Dilution: A Biochemical Method of Purification," which Dr. W. E. Adeney, F.I.C., read at a meeting of the Institute of Sanitary Engineers held in London on the 1st inst., Mr. A. P. I. Cotterell, the president, in the chair. The reading of the paper was followed by discussion.

Major A. J. Martin (Westminster), in moving a vote of thanks to the author, said he had listened in his time to a great many papers on the purification of sewage, but he had never heard a more useful one than that which Dr. Adeney had presented to them. The author had given them an exceedingly clear view of the complicated processes which took place in the purification of sewage. He had traced those processes very clearly in reference to the different conditions—solid and liquid—in which the polluting matters were found. The disposal of sewage by dilution had been looked upon in this country as one of the cardinal sins. There was a certain type of sanitary conscience which regarded the admission into a stream of unpurified sewage as a wicked and reprehensible proceeding. It had never appeared so to him, because what they aimed at in sewage purification was the oxidation of the polluting matter, and he had never seen a process which seemed so rational, effective and inoffensive as bringing the oxygen required for purification into contact with the polluting matter in the shape of oxygen dissolved in a sufficient quantity of water. He thought that the paper, advocating as it did a return to natural means of purification, might have a very great effect in restricting the lavish expenditure of public money on works to which they had been accustomed in the past.

Mr. G. B. Keeshaw (Westminster) seconded the vote of thanks.

Mr. H. C. H. Shenton (Westminster) thought there was some danger, after hearing Major Martin's remarks, that we might begin to lessen our care in the treatment of sewage simply because of the light thrown on the subject by such workers as Dr. Adeney.

Mr. H. Percy Boulnois (Westminster) gave an instance of purification by dilution some forty years ago, when the town of Tiverton, then a place of 8,000 inhabitants, poured the whole of its crude sewage into the river Exe, 12 miles above Exeter. Samples taken the whole way down showed that the river became purer and purer until at Exeter it was absolutely purified and potable. They did not know then the cause of that purification, though they assumed that the air and various forms of life in the water were doing the work; but Dr. Adeney had now opened his eyes to what had happened. The difficulty which he saw with regard to purification by dilution was that, whatever recommendations on the subject might emanate from the Royal Commission, these were rendered absolutely inoperative by Acts of Parliament under which it was necessary to purify sewage to an extraordinary extent before the effluent was allowed to reach even the largest bodies of water.

The President, in closing the discussion, commented on the need for economy in the future, and suggested that it would be necessary to use our brains a little more in order to relieve our pockets. In doing that he thought they would find that the methods put before them in Dr. Adeney's paper were methods they could adopt. Even in our most perfect sewage works we depended on dilution of the effluent in our streams. Dr. Adeney had drawn a proper distinction between the disposal of solids and liquids, and all would agree that solids should, as far as possible, be eliminated from the stream. But having done that they wanted to instil into the country the fact that rivers would bear a greater burden than we had been accustomed to regard them as capable of doing. Of course, there were certain ingredients which must be specially dealt with, but having dealt with those we need not have the fear we used to have that, by making use of the dissolved oxygen in streams, or introducing into the latter some purified liquid sewage, we should be carrying disease to the places lower down.

The vote of thanks was carried, and, Dr. Adeney having replied, the meeting closed.

Change of Address. Messrs. Henry Faija & Co. inform us that on and after December 25th their address will be 6 Earl-street, Westminster, S.W.

LOWER THAMES VALLEY DISTRICT SURVEYORS' ASSOCIATION.

MUNICIPAL ECONOMY DISCUSSION.

There was an excellent attendance of members at Twickenham on Saturday, the 4th inst., for the discussion of the paper on "Municipal Economy in War-time," read by Mr. E. Willis, engineer and surveyor to the Chiswick Urban District Council, at the previous meeting. [The Surveyor, November 12th and 19th.] Mr. R. R. Jeffes presided. The very keen interest of the members in the subject under review was evident, practically all those present offering suggestions or criticisms upon the paper.

Mr. M. Hainsworth (Teddington), who moved a vote of thanks to Mr. Willis, opened the discussion by expressing his doubts as to the advisability of using tarred granite (as recommended in the paper) for patching potholes. His experience was that potholes repaired with tarred granite soon became raised mounds, owing to the more rapid wear of the surrounding macadam. With regard to the surface dressing of land with sludge, he had used it for field dressing, but found it unsuitable for "rich" land.

Mr. F. W. Pearce (Twickenham), who seconded the vote of thanks, remarked on the boldness of Mr. Willis in advocating economies in the work of other departments. With regard to house refuse, a notice had been sent to residents in his district (as suggested by Mr. Willis) asking them to burn as much as possible of their refuse, with the result that a considerable sum had to be spent for coal for use in the destructor to compensate for the falling off in calorific value of the refuse burnt. Mr. Pearce expressed the views of most of those present that the greatest economy should be effected by postponing street widenings and improvements, that considerable savings had, without serious inconvenience, been effected by the reduced lighting, and that certain savings could be made on street scavenging, but that reduced expenditure on sewers or sewage disposal works was false economy.

Mr. S. H. Chambers (Hampton) thought the paper ought to have been called "Municipal Efficiency with Economy in War-time." He did not advocate the use of slag in lieu of granite chippings for tarred roads. Several roads tar-painted and covered with slag chippings last summer had not turned out so satisfactory as when covered with granite chippings. Mr. Chambers outlined a scheme he had prepared for his district to utilise the services of the older boys from the council's schools for snow removal in case of a heavy fall, and explained a new type of small hand snow plough which he had designed.

Mr. J. G. Carey (Heston and Isleworth) stated that he had extended the use of hand trucks for street scavenging with satisfactory and economical results, and added that in his district certain savings had been made by closing the slipper baths in the public baths. He also advocated on the score of economy the outside painting of public buildings every four years instead of three.

Mr. C. H. Cooper (Wimbledon) suggested that care should be used in the use of the word economy; anything which reduced the efficiency of the sanitary administration of a district should not be called economy. He also stated that horse hire had increased to 15s. per day, and he now contemplated using a motor bicycle with special attachment to carry tar for minor repairs.

Mr. J. H. Brierley (Richmond) asked what the author of the paper meant by a more extended use of waste land, and also in what capacity Mr. Willis had employed female labour. He pointed out that reduced expenditure on recreation grounds and parks was, under present circumstances, an advisable economy. He also advocated the earlier closing of underground conveniences. The postponement of tree pruning was also advocated as an advisable economy.

Mr. H. F. Coales (Sunbury-on-Thames) asked for information as to the effect of war bonuses, and as to whether the author knew of any places where Boy Scouts had been engaged in snow removal, and so forth.

Mr. R. Wilds (Walton-on-Thames) objected to the word "economy," but admitted "retrenchment" might be possible in some places.

The President closed the discussion by putting the vote of thanks, which was unanimously carried.

Mr. Willis, in replying, said the paper had certainly been of advantage in promoting discussion upon several important points. In reply to Mr.

However, his experience in patching with tarred [illegible] had been on the whole satisfactory for small repairs, and he was even now repairing with tarred clinker, which up to the present had also proved successful. In reply to Mr. Pearce, as the members knew, in Chiswick gas was largely used for pumping, and steam from the destructor was only used for minor works and flag-making, and hitherto he had always had sufficient steam, in spite of the reduced quantity of house refuse. He would point out that it was not he had not suggested any material reduction on sewers and sewage disposal works, except when palpably not necessary for efficiency, which sometimes happened in the case of routine work. In reply to Mr. Chambers, Mr. Willis quite agreed with the paramount necessity of "efficiency." He had had the same experience with slag chippings some years ago, being satisfied that good granite chippings were most economical when dressing roads with tar, and he had therefore refrained from the use of slag for several years past. He expressed his thanks to Mr. Chambers for the suggestion as to utilising the services of older boys in the case of snow removal, but felt there was some risk in doing so unless provision was made for the boys being suitably clothed and shod. He was glad to note that Mr. Carey had extended the use of hand trucks for street scavenging. These he had also had in use now in the main road for the last seven years, and he was quite satisfied as to their efficiency and economy. In reply to Mr. Brierley, his only experience of external female labour was in weeding at the sewage disposal works, and he must admit that had been well done. At the present time the whole of the spare land owned by the council was being actually utilised, but had there been any further slop-shoots available, he considered it would have been wise to utilise these for the growing of vegetables or other produce. The only economies he had been able to effect in regard to recreation grounds, commons, &c., was in obtaining a little greater amount of labour out of the keepers [illegible] by the giving extra help [illegible] as had been done in past years. He was quite in agreement as to earlier closing of conveniences, and economy in tree pruning; but he would sound a note of warning in regard to the latter item, since only last year he lost a number of trees through excessive economy, the large tops in several instances having, through lack of pruning, caused trees to be blown down. Mr. Willis also dealt with a number of other points raised in the discussion.

At the next meeting of the association, which will be held at Wimbledon, Mr. C. H. Cooper will read a paper on "Activated Sludge."

CORRESPONDENCE.

Ἓις ἀνὴρ οὐ πᾶσ' ὁρᾶ
One man does not see everything.)
Euripides

PUBLIC LIGHTING: GAS COMPANIES' ALLOWANCES.

To the Editor of The Surveyor.

Sir,—I should be glad of information, through The Surveyor, as to what is being done in other towns in the above matter, and I am of opinion such information would be appreciated by others.

My council made an arrangement with the gas company to deduct from their account for public lighting for all gas which should, according to the contract, be consumed in the public lamps, but which may not have been used through the restrictions by the police.

Gas so deducted was allowed for at 2s. 4d. per 1,000 ft., the price at which the gas is charged to the council.

The company made no allowance for reduced maintenance—this, I contend, should have been done.—Yours, &c.,

Somerset.

December 9, 1915.

[Information on the point raised by our correspondent was supplied by speakers at the recent Eastern Sub-District meeting of the Institution of Municipal and County Engineers, held at Bury St. Edmunds, and reported in our issue of last week; but we shall be glad to receive for publication particulars as to the allowances made in other towns.—Ed. Surveyor.]

To the Editor of The Surveyor.

Sir,—I notice in your issue of December 10th that Mr. Eley, when replying to points raised by several speakers in the discussion of his paper, "War-time Economy by Local Authorities," read at the Eastern Sub-District meeting of the Institution of Municipal and County Engineers at Bury St. Edmunds, "thought it would be useful if they could obtain information as to what gas and electric lighting companies were allowing councils per standard in those districts where public lighting was very severely restricted or prohibited, and particularly what was being done where contracts existed."

It may be of interest to Mr. Eley and other members of the institution to learn that I have recently circularised twenty-one towns in the East of England on this subject, the replies to which I have tabulated, and a copy of which tabulated returns I have sent to the secretary of the Institution of Municipal and County Engineers for the use of other members.—Yours, &c.,

B. J. Wormleighton.
Town Surveyor.

Loftus, Yorks.
December 14, 1915.

[We may say that we have applied to Mr. Wormleighton for a copy of his return, and hope, in anticipation of his courtesy, to be able to reproduce it in our next issue.—Ed. Surveyor.]

OXFORD TRAMWAYS.

To the Editor of The Surveyor.

Sir,—The paragraph referring to Oxford under the heading "Things One Would Like to Know," in your issue of the 10th instant, is quite out of date, and therefore misleading.

The main line of tramway from the railway stations eastwards through the city has for some time been removed, and the whole of the streets which it traversed repaved with Trinidad asphalt-macadam and tar-macadam, except as to a short length of Rosmac. A large proportion of the branch lines has also been taken up and the streets similarly repaved.

The total route length operated upon so far is about 3 miles, and the central portion of the city has thus been practically cleared of tramways. The removal of the remainder and the repaving of the roads is proceeding rapidly, and will probably be completed during the next few months.

The negotiations between the tramway company and the council were necessarily of a protracted nature, and eventually an Act of Parliament was passed for the transfer to the corporation of the tramways—which were in a very bad condition—and for establishing a service of motor omnibuses.

Sanction to a loan for the reconstruction work was subsequently obtained through the Local Government Board, and those works were taken in hand without undue delay.

I suggest to your contributor the desirability of ascertaining the facts before committing himself to print as to cases of which he has not personal knowledge.—Yours, &c.,

Wm. Hy. White,
City Engineer.

Oxford.
December 14, 1915.

[Our contributor, to whom we have submitted the foregoing, writes: "Mr. White's letter clearly explains the present position with regard to the Oxford tramways and the streets of that city. My apologies are due to Mr. White for having been misled by a short statement in the Press a week or two ago that the tramways were about to be removed, whereas it now appears that the majority of the tramlines were removed some time ago. To err is human, and I hope Mr. White will forgive me."—Ed. Surveyor.]

Sewage Treatment After the War.—When the war is over and ordinary municipal activities have been restored throughout Europe, there may (says *Engineering News*) be some surprising realignment of sewage treatment. Necessary economies will force all the European countries engaged in the war to adopt a rational rather than an ideal sewage-treatment policy, such as has been practised in Germany for a decade or two. Partial processes, like screening and tank treatment, will doubtless be widely employed, and in many instances nothing more may be feasible for years to come. If the activated sludge process is shown to be an economic success it bids fair to be adaptable to almost any degree of treatment, and thus to find its way to all parts of the world. By the time the war is over, the possibilities of this most interesting and promising method of sewage treatment will probably be determined.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Exeter T.C.—It has been agreed to purchase a site for a small-pox hospital, at a cost not exceeding £500.

Hawick T.C.—It is proposed to make additions to the Anderson sanatorium, at an estimated cost of £1,500.

Itchen U.D.C.—The Local Government Board wrote reverting to the council's letter with respect to the proposal to spend a sum estimated at £3,125 out of revenue on the provision of an isolation hospital. With reference to the proposal to defray the expenditure by instalments extended over a period of two and a-half years, the board were advised that if, as they assumed was the case, the whole of the work was to be done at once, the council would have no legal authority apart from a loan under the board's sanction to extend the payments in the manner suggested.

Lowestoft T.C.—The borough surveyor, Mr. G. H. Hamby, reported that during the continuous stormy weather recently a heavy scour took place on the South Beach. He had adopted temporary measures of protection, and he was of opinion, after careful examination, that to save the position of the wall and cliffs it would be necessary to sheet-pile below the foundations of the wall for about 80 ft., and fix land-ties from each main pile. The estimated cost of the work would be about £400. The borough surveyor was directed to carry out the sheet-piling, as suggested.

Runcorn R.D.C.—Plans have been approved for the extension of the cottage hospital, at an estimated cost of £500.

Wellingborough U.D.C.—The surveyor, Mr. E. Y. Harrison, is preparing quantities for a proposed public convenience.

HOUSING AND TOWN PLANNING.

Huntingdon T.C.—Arrangements have been completed for the acquisition of Stoney Close as a site for the erection of working-class houses.

Lanark C.C.—Arrangements have been completed by the Middle Ward Committee and the Finance Committee for proceeding with the scheme for building 150 cottages at Mossend. The Ministry of Munitions has promised a contribution of £4,000 towards the cost.

Whitley and Monkseaton U.D.C.—Mr. Harvey, in presenting the report of the Town Planning Committee, said the committee were seeking to co-operate with the landowners, and were endeavouring to ascertain whether they had any preconceived ideas in regard to the development of their land. The committee were now, therefore, actually on the road to making a town planning scheme for the district. It would be a very long job, and would take two or three years to complete.

PARKS AND OPEN SPACES.

Warrington T.C.—The borough surveyor, Mr. A. M. Ker, has been instructed to prepare a plan for laying out the land on the south-east side of Warrington Bridge.

REFUSE COLLECTION AND DISPOSAL.

Jarrow T.C.—The council have resolved that the town's scavenging shall be done by means of direct labour.

Omagh U.D.C.—The question of providing receptacles for domestic refuse has been referred to the Public Health Committee for consideration and report.

Southgate U.D.C.—A report has been submitted by the Public Health Committee on the collection of refuse by motor vans, and a committee has been appointed to go into the matter.

ROADS AND MATERIALS.

Axholme R.D.C.—The employment of old-age pensioners on the roads to set at liberty more able-bodied men for farm work was strongly advocated by Alderman T. J. Blaydes and Alderman Stephenson, and it was stated that the Pension Commissioners had altered their regulations so that an old-age pensioner might now earn as much as he could without prejudicing the amount of his pension. Alderman Blaydes also spoke in favour of the employment of women for road sweeping and the lighter parts of the road work. Instructions were given the surveyor, Mr. B. West, to ascertain whether there were in the district old-age pensioners who had given up work under the misapprehension that their pension would be affected if they earned more than 8s. a week, and to offer them employment on the roads, also to supplement the work by the employment of women where possible.

Colchester T.C.—Authority has been given for paving with granite setts the portion of Hythe Hill on the north side from a point about 50 yds. east of St. Leonard's Church to the Hythe Quay.

Devon C.C.—The Bridges and Main Roads Committee on Tuesday reported the further consideration of the application of Southmolton Rural District Council for the approval of the appointment of Mr. Ernest Kingdom as one of the Southmolton district surveyors, and they approved of the appointment, subject to the district council providing Mr. Kingdom at their own expense with a motor cycle, to enable him to supervise properly the work of maintaining the main roads.

East Dereham U.D.C.—In compliance with the suggestion of the Government on economy, a letter was received from the Eastern Highways Committee that they did not intend to incur any expenditure on road tarring or watering county roads, and that no allowance would be made to any urban authority for any of those items, commencing from April 1st next. The surveyor, Mr. F. L. Burch, reported that the use of tar was the most economical method of keeping the roads in repair, and expressed the opinion that the proposed step by the Highways Committee would be false economy. The clerk was directed to write to the county council, putting the views of the surveyor before it.

Helston T.C.—The council have adopted a recommendation of the Main Roads Committee to ask the county council to take over the maintenance and repair of parts of the main roads in Clodgy-lane, and from the entrance of Clodgy-lane to Killianchor and Aver's Corner, on the Gweek road, and that the contract with the county council in future relate only to the remainder of the main roads in the borough.

Isle of Wight R.D.C.—The clerk to the county council, Mr. J. Dufton, wrote stating that the Roads Committee had received complaints that tar-spraying had made the surface of some of the roads very slippery and dangerous for horses. It was undesirable to tar-spray steep gradients in future, and they suggested that where they had already been tarred grit should be sprinkled occasionally.

Lowestoft T.C.—It has been decided to make up Harbour-road.

Oakham R.D.C.—A letter was received from the county council as to whether this district council, as the highway authority, could retrench in any way with regard to the cost of upkeep of the roads. To this the council have replied that, as they would have to pay in the future, as they were doing now, more for material, team labour, and manual labour, it would be impossible to undertake to maintain the roads at any less price than had been allowed during the current year.

Retford R.D.C.—It was reported lately that arrangements had been made with the county council by which overlapping roads would be repaired by the two authorities interchanging labour.

Scarborough T.C.—The Local Government Board are being asked for sanction to a loan for the repair of the landslip in Clarence Gardens.

Southwark B.C.—The Works and Depot Committee recommend the purchase of a motor slop van.

Swindon T.C.—Property and land costing £600 are to be purchased for a widening scheme in Wroughton-road.

Truro R.D.C.—A proposal is being considered for the construction of a new road at Kenyn and Kea.

Westhoughton U.D.C.—The surveyor, Mr. George Hayes, reported that during the recent spell of frost they used about 14 tons of salt on the roads, the cost of distribution being about £16. The judicious use of salt instead of the old system of ashing had resulted in a considerable saving in expense as well as keeping the roads in a much better condition.

SEWERAGE AND SEWAGE DISPOSAL.

Elgin T.C.—The burgh surveyor, Mr. A. A. Turriff, has been instructed to ascertain the cost of carrying out arrangements proposed by him to prevent a recurrence of the flooding at the foot of Lossie Wynd. Though this step has been taken, it may not be expedient to take further action until after the war.

Exeter T.C.—The city council on Tuesday approved the report of the Sanitary Committee recommending improvements at the sewage disposal works, at an estimated cost of £10,000. In reply to questions, the city surveyor, Mr. T. Moulding, stated that a Local Government Board inquiry would have to be held and expert judgment passed upon the scheme. Nobody could say whether the effluent would be satisfactory or not—so much depended upon the flow of the river into which the effluent passed. If the flow of the Exe was always as great as at present no more work would be required than screening. It was in the summer months that other work was required. He believed the effluent in the summer would be better under this scheme. The Local Government Board might require a storm-water tank, but that would not be costly. Replying to Alderman Ross, he said the experimental work had saved the council thousands of pounds. Having regard to the flow of the river, the works now were as good as any in the country. What they had to do was to clean the clinkers and wash the tanks more frequently than formerly.

Loughrea R.D.C.—A letter has been received from the Local Government Board stating they had recommended the Commissioners of Public Works to issue to the council a sum of £500, being the second instalment of the loan of £8,250 sanctioned for the purpose of carrying out a sewerage scheme for the town of Loughrea. The letter added that the board, in view of the report they had received from their engineering inspector, Mr. Price, relative to his recent inspection of the works, were, at the same time, of opinion that the council would be well advised to close down the works and to re-open them at the conclusion of the war, when employment would be much needed, and their completion would not be long delayed. The clerk was directed to intimate to the Local Government Board that the council were of opinion that, in view of the scarcity of employment and the urgent need for the sewerage works, the work should be continued, and recommended its continuance until the scheme be completed.

Swindon T.C.—The borough surveyor, Mr. H. J. Hamp, has received instructions to report on a scheme for the improvement of the filter-beds at the Rodbourne sewage disposal works.

Wantage R.D.C.—It is proposed to carry out a scheme of sewage filtration for the parish of Harwell.

WATER, GAS, AND ELECTRICITY.

Axbridge R.D.C.—It has been decided to purchase for the South Marsh waterworks pumping station a 30 b.h.p. horizontal oil engine (to use crude oil) and a 26 b.h.p. pump, at £315 and £310 respectively, and that the payments be extended over the longest possible period.

Bath T.C.—The Electric Lighting Committee recommend the corporation to purchase a new feeder for electrical power extension.

Belfast T.C.—A scheme has been adopted for lighting the central area of the city by electricity.

Burnley T.C.—It is the intention of the corporation to promote a Bill for the extension of the time for the completion of the Hurstwood reservoir and the catchwater drains or conduits, and other works authorised by the Act of 1908.

Burton-on-Trent T.C.—The Electricity Committee have adopted a proposal for the extension of electricity mains, at an estimated cost of £6,700.

Lincoln T.C.—It has been resolved to increase the price of gas by 3d. per 1,000 ft., this being the second increase during the year, and bringing the price to 2s. 6d. per 1,000 ft. It was stated that the price for electricity would also be increased on January 1st next.

Lleyn R.D.C.—A report is to be prepared on the cost of sinking a shaft for a supply of water for Ochrymyndd and Llanbedrog.

Newry U.D.C.—The nett profit of the gas undertaking for the financial year ended March 31st last was £230, compared with £127 in the previous year. The capital expenditure during the year included £433 for the renewals to the gasometers, and £484 for renewal of retorts.

Nuneaton T.C.—An intimation has been received that the Local Government Board will offer no opposition to the corporation's proposed loan of £10,000 for the extension of the electricity plant.

Stoke-on-Trent T.C.—It has been decided to renew part of the Burslem gasworks plants, at an estimated cost of £3,750.

Torquay T.C.—The Local Government Board have waived their objections to the laying of the second section of the new water main from the Dartmoor reservoirs, at an estimated cost of £50,000.

Worcester T.C.—It has been agreed to carry out a water main extension at an estimated cost of £400.

MISCELLANEOUS.

Cork R.D.C.—It is proposed to fix twenty fire hydrants on the water mains, subject to sanction to a loan for the cost being obtained from the Local Government Board.

Finedon U.D.C.—The clerk, Mr. T. J. Morgan, reported that he had waited upon the Local Government Board with reference to the proposal of the council to combine the offices of sanitary inspector and surveyor and to advertise for a man to carry out those duties. The board suggested that the council should reconsider their decision and allow the present arrangement to remain in force until the end of the war, as otherwise it might lead to the council appointing a man of military age. In answer to Mr. Leonard, the inspector (Mr. Lloyd) said he was of military age, but had offered himself and been rejected. The council decided to adopt the view of the Local Government Board, and both the surveyor (Mr. G. F. Bearn) and the inspector (Mr. Lloyd) agreed to carry out their duties for the period suggested.

Hove T.C.—The mayor read a letter from the town clerk stating that the council would be glad to learn that since the last meeting, when resolutions relative to the enlistment of the staff were passed, every member of military age except one of the various staffs held to be indispensable had offered himself for enlistment under Lord Derby's scheme. In that one case there were very exceptional private circumstances which stood in the way. Of those not held to be indispensable all had enlisted except two, one of whom had applied for a commission, and would, he understood, receive it shortly.

Ryde T.C.—Sanction is being sought to a scheme for the acquisition by the corporation of Victoria Pier, and to the construction of swimming and other baths in connection therewith.

Sunderland T.C.—The council have agreed to the recommendation of the Watch Committee to purchase a motor fire engine from Messrs. John Morris & Sons, Manchester. A resolution had been passed by the committee that the various insurance companies should be written to asking if they would contribute towards the cost of the engine, and the town clerk read a reply he had received from the Municipal Mutual, stating that the companies could not be expected to entertain such a proposal, and asking whether the council's Watch Committee did not consider *infra dig.* for a wealthy corporation like that of Sunderland to ask for contributions towards a fire engine to cost £1,200 or £1,500?

Back-to-Back Houses in Bolton.—The borough surveyor of Bolton, Mr. E. L. Morgan, in the course of an address recently at the Spinners' Hall on "Housing in Bolton," stated that in 1851 the majority of the houses of the working classes appeared to have been back-to-back houses, and that in 1891 the number of such houses was 3,051. Between 1874 and 1895, a period of twenty-one years, 538 houses were demolished, closed, or made fit for habitation, an average of twenty-seven per annum. From 1896 to the present time 1,023 houses of this class had been demolished, 476 closed, 588 made fit, and 105 improved, a total of 2,192 houses dealt with, an average of eighty-seven per annum. The work had cost the corporation £43,600.

PERSONAL.

Mr. H. Howard, surveyor to the Littlehampton Urban District Council, has resigned.

Mr. John Groom, surveyor to the Ellesmere Urban District Council, has resigned his position owing to ill-health.

Mr. A. G. Wheeler, assistant surveyor of Colchester, has accepted a temporary commission in the Royal Engineers.

Mr. Wilfred F. Alderton, who has just completed his articles with the surveyor to the Aldershot Urban District Council, has been gazetted to a Lieutenancy in the 4th Hants Regiment. Mr. F. C. Uren, the surveyor, is thus left without his last means of assistance, his permanent staff and those who replaced them having joined H.M. Forces. Mr. Uren has himself applied for a commission in the Royal Engineers, but his council have refused to grant him the necessary leave.

Mr. John Gordon, who, as already announced, has been appointed burgh surveyor of Aberdeen, served an apprenticeship in the office of the engineer-in-chief of the Great North of Scotland Railway Company under the late Mr. P. M. Barnett, and was subsequently one of Mr. Barnett's assistants for a year.

Mr. John Gordon,
The New Burgh Surveyor of Aberdeen

In 1888 he received an appointment as an engineering assistant in the Aberdeen burgh surveyor's office under the late Mr. William Boulton, who was succeeded by the late Mr. William Dyack in 1892. In 1897 Mr. Gordon was unanimously appointed by the town council to be assistant burgh surveyor in succession to Mr. Lynham, and has held that post up to the present time. For a year past, since the death of Mr. Dyack, the sole charge of the department has devolved on Mr. Gordon. Mr. Gordon is a graduate and member of the Institution of Municipal and County Engineers, an associate member of the Institution of Civil Engineers, and a past-president of the Aberdeen Association of Civil Engineers. He holds the Honours Certificate of the Science and Art Department in building construction, and for a number of years was one of the lecturers in the technical evening classes at Gordon's College. Mr. Henry Steuart, who becomes assistant burgh surveyor, is a native of Banchory. He was trained in the burgh surveyor's office, and has been on the staff for twenty-eight years.

Mr. Arthur Race, borough engineer and surveyor of Barrow, who has been appointed to a similar position at Blackburn, has been complimented by the Health Committee of the former borough placing on record their appreciation of the efficient services rendered by him during the seven years he had been at Barrow. The committee wished him every success in his new appointment. The mayor (Alderman Barrow) said he would like to pay a tribute to the services of Mr. Race. He had had a lot to do with him in the erection of schools, and during his mayoralty he had come into very close contact with him in various ways. Mr. Race had been an excellent surveyor, and conducted difficult negotiations with the greatest skill. He had in every way served the corporation well, and he (the mayor) was sure they all wished him every success in his new sphere of labour, which he would occupy from January 1st.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Beaconsfield U.D.C. (December 7th. Mr. P. M. Crosthwaite).—£4,500 for works of private street improvement.—It was explained that it was proposed under the scheme to make up Baring-road, Baring-crescent, and Reynolds-road.

Lancaster T.C. (December 9th).—This was an inquiry into an application for a Provisional Order to amend the Lancaster Corporation Acts, so as to borrow a sum not exceeding £80,000 for the extension of the gas undertaking, and to enable the corporation to run motor buses; to borrow £4,200 for sewerage work, the immediate necessity being occasioned by the prospective increase of 15,000 in the population through Government works. There was no opposition.

APPLICATIONS FOR LOANS.

Bedwellty U.D.C. – £300 for a tar-dehydration plant.

Hornsey T.C.—£500 for electricity mains.

Redditch U.D.C. £12,512 for the reconstruction of the electricity works.

LOANS SANCTIONED.

Barrow T.C.—£2,000 for new water mains.

Derby T.C.—£2,043 for electric motors, and £1,927 for mains.

Dumbarton T.C.—£510 for filtration and aëration plant.

Hull T.C.—£20,000 for the electricity undertaking.

Newport (I.W.) T.C.—£1,506 for water pumping plant.

Rochford R.D.C.—£3,900 for works of sewage disposal.

Westminster B.C.—£23,775 for street improvements.

FORTHCOMING INQUIRIES.

DECEMBER.	£
23.—**Bentley.** For works of sewage disposal (Mr. A. G. Drury)	2,030
TOWN PLANNING.	
31.—**Bentley.** (Mr. George L. Pepler) ...	—

FOR OTHER ADVERTISEMENTS
See End of Paper.

ALDERSHOT URBAN DISTRICT COUNCIL.
SURVEYOR'S CLERK.

The above Council requires the services of a Clerk, male or female (the male must be ineligible for military service), in the Surveyor's Department.

A shorthand writer and typist, and one experienced in the keeping of accounts of such a department, and capable of preparing tracings preferred.

Applications, stating age, experience, and wages required, together with copies of 3 testimonials, to be sent to the Surveyor on or before 31st inst., endorsed "Surveyor's Clerk."

FRED. H. DOMINEY,
Acting Clerk.

Municipal Buildings,
Aldershot.
December 15, 1915. (2,793)

STEAM FIRE ENGINE and Suction Hose for Sale; Shand Mason's; 450 gallons; 80 lb. steam pressure. Thoroughly good order and complete. £105, on rails, Norwich.—Arthur E. Collins, Engineer, 1 Carrow-hill, Norwich. (2,795)

TO ENGINEERS.—The Gosport and Alverstoke Urban District Council invite Tenders for the Supply of a New Fly-wheel, Crank-shaft, Steam and Air Eccentrics, Spindles, &c., for existing Steam-engine Air Compressor. Specification can be seen, and Form of Tender obtained, on application to the Engineer and Surveyor to the Council, Town Hall, Gosport.

Tenders addressed to the Clerk to the Council, sealed and endorsed "Tender for New Fly-wheel, &c.," to be delivered at the Council Offices at or before 10 a.m. 4th January, 1916. (2,794)

THINGS ONE WOULD LIKE TO KNOW.

[illegible]

* * * *

[illegible] the House of Commons the other night, that the cost of the collection of street refuse in the City of West- [illegible] and it was not denied by the President of the Local [illegible] practices in this wealthy Metropolitan borough? [illegible] the reason why this extraordinary cost is necessary?

* * * *

[illegible] wonderful bazaar held recently at the Albert Hall, and called "Christmas in War-time," will materially add to the funds of the Committee of the Professional [illegible] been ungrudgingly given to those of the working classes who have suffered, is it not a fact that there are hundreds of professional men who have found themselves in reduced circumstances owing to the war, and has not the above-mentioned committee done excellent work in relieving much of the distress which has thus been caused?

* * * *

[illegible] and County Engineers to be congratulated on having started upon the Herculean task of endeavouring to standardise forms for statistics on the various and multitudinous works upon which surveyors throughout the country are engaged? Would not such a standardisation go far to assist surveyors in preparing statistics for themselves, and in obtaining reliable information from other surveyors when they are seeking information on matters with which they [illegible]

* * * *

Was not Dr. Adeney's paper on "Purification of Sewage by Dilution," which he gave a short time ago at the Institute of Sanitary Engineers, a brilliant example of how a man who thoroughly knows his subject can make it clear to his audience? Did he not deal with a difficult scientific subject in a lucid and clear manner which threw light on some of the problems which have hitherto perplexed many engineers and others who have dealt with the subject? Is not the subject of purification by dilution one of great interest at the present time when so many camps are obliged to send their sewage into streams or rivers with but very little preliminary treatment?

* * * *

Was not the scathing indictment of the London County Council tramway service in the *Star* of December 7th another nail in the coffin of that now almost obsolete vehicle the tramcar? Is it not evident that, with the advent of the flexible motor omnibus, the doom of that rigid, unwieldy and inconvenient street vehicle, the tramcar, has been sounded? How long shall we yet suffer these traffic obstructors to block our streets?

* * * *

Is it not to be hoped that road authorities and surveyors throughout the United Kingdom will give up the use of crude tar for all roadwork during the war, when they now know that certain products of crude coal-gas tar are required for the manufacture of high explosives? Is there not also some objection to using crude tar for roadwork, and have not some of the failures of tar-painting the surface of the roads and the use of this material for tar-macadam been due to the use of crude tar?

* * * *

Is the darkening of our streets carried on in a scientific and reasonable manner? Is there not a sad lack of uniformity and co-operation between the different authorities in the matter of public and private lighting, with the result that, whereas in some streets there is always up to a late hour at night quite sufficient light to guide an enemy's airship, there are other streets which are so dangerously dark that traffic is almost impossible? Why should there not be a Minister, or controller, of public lighting, as well as one for munitions?

SOME RECENT PUBLICATIONS.*

Counted by Scouts. A Scouting Story. By Mark Harborough. Price 2s. 6d. nett (post free, 2s. 9d.). Glasgow: James Brown & Son.

We have no hesitation in giving space to a notice of this excellent yarn, because, first, it thoroughly deserves wide publicity, on its merits; and, secondly, because the pen-name adopted by the author cloaks the identity of a well-known municipal engineer. Times out of number we have emphasised the versatility of such officials, and the work before us affords another notable illustration. So, also, it tends to discredit the proverb as to the cobbler sticking to his last, for herein the author shows that it is possible to cultivate the gift of imagination, to transport oneself to the world of make-believe, and yet to do efficiently the exacting every-day work of a practical engineer. In fact, it must be that this work is even better done if the official can come to it with the freshness that follows an occasional switching off on to a hobby which means the change that is surely rest. In this case the author's best apologia is that he has written a book that should be read with avidity by every boy. And we have a shrewd suspicion that parents themselves, if they are tempted just "to dip into it," will continue the dipping process until they have read the book through. We confess that its well-sustained plot induced us ourselves to read every [illegible] which, *entre nous*, is not always pursued by the hardened reviewer. Other municipal engineers should certainly buy it for their own youthful sons, and could with confidence give it as a timely present to their friends' sons. We can assure them they will thereby earn the warm gratitude of their little friends. As to the tale itself its character is well suggested by the publishers' announcement, which speaks of it as "A story of outdoor life. It smells of the wood and camp fire, and one can hear the laughter and ragging of the boys." "Mark Harborough" certainly knows and appreciates the appeal of the open country and the ways of its furred and feathered occupants; and with equal thoroughness he knows the ways, and habits, and thoughts of the normal boy. And he has the gift of conveying it all to his readers in good, unaffected English, enlivened all through by the saving grace of natural and kindly humour. We would add that the book is bound attractively in full cloth, the front cover bearing an effective coloured illustration. Other full-page black-and-white pictures by R. W. Coales also cleverly help one to visualise the scenes and characters referred to in the text.

Bournemouth Trams and the Darkened Streets.—Bournemouth Town Council recently adopted the recommendation of the Tramways Committee that from last week to January 10th the time of closing down trams in the borough be 10.30 p.m. It was stated that the proposal was not for the sake of economy, but simply in the interests of motormen and for the safety of the public owing to the darkened streets.

Combating Dampness.—The first consideration of reparation is the cost, and many wet structures are neglected because the owners are unaware of an inexpensive remedy. The makers of Pudlo state that they will be glad to advise property owners of the least costly way of successfully combating dampness and water in any building. We learn that the well of a lift at Haslingden, which has hitherto been flooded, has been made bone dry with Pudloed cement.

County Down Assistant Surveyors.—Three of the [illegible] rural councils in Co. Down have sent to the county council protests against the proposal to reorganise the staff of assistant surveyors, holding that it was against economy and efficiency to reduce the staff from twelve to six. It is believed that those members of the Proposals Committee of the county council responsible for the suggested scheme will shelve it for a time, if they do not drop it altogether.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

A CONTRACT GUARANTEE BOND.

CLYDEBANK WATER TRUSTEES' APPEAL DISMISSED.

Without calling upon the respondents, the House of Lords recently dismissed the appeal of the Clydebank and District Water Trustees against a decision of the First Division of the Court of Session affirming a judgment of Lord Dewar in an action to recover £5,000 from the Fidelity and Deposit Company of Maryland under a surety policy guaranteeing the performance by a contractor of a contract to lay pipes in connection with a new water supply for Clydebank and district.

The contractors became bankrupt and were unable to complete the work. The Maryland Company repudiated liability because the Water Trustees had not notified the company of the contractor's liability before the bankruptcy to fulfil the time stipulations contained in the conditions of the contract.

The Lord Chancellor, in moving that the appeal should be dismissed, said the contractors should have commenced to lay the pipes in the first week of February, 1909, but the work was not, in fact, begun until two months later. The Clydebank Water Trustees had not given the notice required to the Fidelity and Deposit Company, and they omitted to give a full account of the failure which had occurred. Subsequent delays in the laying of the pipes occurred, and before the work was completed the contractors became bankrupt. Their representatives in bankruptcy refused to complete the work. The Lord Ordinary, before whom the interpretation of the words of the bond came, found that the surety ought to have been notified in writing of any non-observance of the stipulations which might involve a loss for which the surety was responsible, and that in consequence of this the Fidelity and Deposit Company should have received notice in writing of the delays. In his (the Lord Chancellor's) opinion the delay in commencing the work was a breach of the conditions of the contract, which might have involved loss for which the surety would have been responsible, even if subsequently the first bad weather were really the cause of the delay. In those circumstances it was essential, in order to satisfy the condition precedent in the bond, that due notice should be given to the company that such a breach had occurred. The delay was never overtaken, and the subsequent occasions when the pipes were not laid at the contract rate were also breaches of which notice should have been given to the surety, since, in the circumstances of the contract as it then stood, any such default made the prospect of the completion of the contract become more and more visionary, as each default occurred. For these reasons he thought the judgment appealed against was correct.

Lords Atkinson, Shaw, Parker, and Sumner concurred, and the appeal was dismissed with costs.

Cremation at Golder's Green.—During the twelve months ended October 31st last 720 cremations were carried out at Golder's Green, as against 651 for the preceding twelve months.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

INSPECTOR OF NUISANCES.—December 24th.—Corporation of Stafford. £150—£180.—Mr. R. Battle, town clerk, Borough Hall, Stafford.

SURVEYOR AND INSPECTOR.—December 31st.—Mayfield (Staffs) Rural District Council. £100 per annum.—Mr. R. Holland, clerk, Ashbourne, Derbyshire.

SHIFT ENGINEER.—January 1st.—Chertsey Rural District Council. 30s. per week.—Mr. L. Porter, assistant clerk, 80 Guildford-street, Chertsey.

ASSISTANT ENGINEERS.—April 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

ST. ANNES-ON-SEA.—December 22nd.—For the supply of a second-hand building or conservatory suitable for conversion into a floral hall or winter garden, for the urban district council.—Mr. T. Bradley, clerk.

DUNDEE.—December 22nd.—For the building of a cattle depot, for the Dundee Harbour Trustees.—Mr. J. H. Thompson, general manager and engineer, Harbour Chambers, Dundee.

SWINDON.—December 23rd.—For alterations and additions to a cottage, for the corporation.—Mr. J. H. Hamp, borough surveyor, Town Hall.

MANCHESTER.—December 24th.—For extensions of the gas stove repair works, for the Gas Committee.—City Architect, Town Hall.

DARTFORD.—December 30th.—For the erection of thirty houses, for the urban district council.—The Surveyor, Council Offices, Dartford.

Engineering: Iron and Steel.

LONDON.—December 22nd.—For the supply of gunmetal valves (bib and pillar), for the Commissioners of Works.—Controller of Supplies, H.M. Office of Works, 18 Queen Anne's-gate, Westminster, S.W.

NUNEATON.—December 24th.—For the supply and erection of an overhead line, for the Electricity Committee.—Mr. H. Hodges, acting borough electrical engineer, Electricity Works, Nuneaton.

BURY.—December 27th.—For the supply of iron castings, for the Bury and District Joint Water Board.—Waterworks Manager, Parsons-lane, Bury.

JOHANNESBURG.—December 30th.—For the supply and erection of ice-making and refrigerating plant, for the municipal council.—Intelligence Branch of the Board of Trade, 73 Basinghall-street London, E.C.

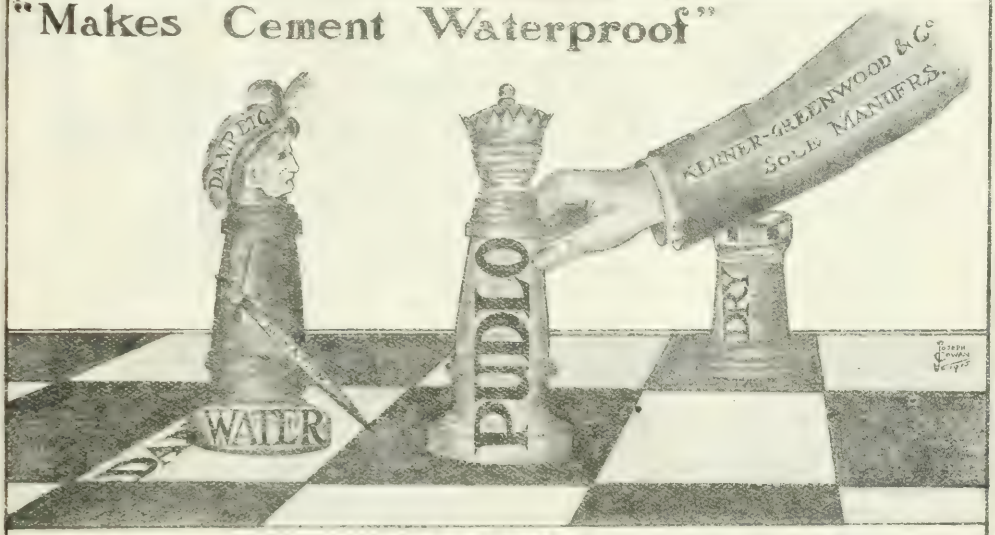
DURBAN.—December 31st.—For the supply of telephone apparatus and materials, underground cables, and cast-iron pipes, for the Telephone Department.—Messrs. Webster, Steel & Co., London Agents, 5 East India-avenue, E.C.

NEWTON-IN-MAKERFIELD.—January 3rd.—For the supply of two Lancashire boilers, a steam-driven gas exhauster, a direct current set of 25 horse-power, cast-iron gas mains and specials, excavating trenches, erection of a boiler-house, and the construction of a reinforced-concrete tar and liquor well, for the urban district council.—Mr. R. T. Surtees, gas engineer, Gasworks, Newton-le-Willows.

PORTLAND.—January 5th.—For overhauling and repairs to a set of three-throw deep-well pumps, fixing a set of engine gearing, and other works, for the Waterworks Committee.—Mr. A. S. Lilley, engineer and surveyor, Council Offices, New-road, Portland.

BLAST FURNACE SLAG
From 14 cwt. to 24 cwt. per cubic yard
COLD BLAST TO ANY SPECIFICATION FOR ALL PURPOSES.
JOHN FREAKLEY & CO., Ltd., Conveyance Slag Works, DUDLEY PORT, TIPTON.
Telegrams—"Freakley, Tipton." Telephone—No. 3 Tipton

"Makes Cement Waterproof"



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Pudloed Cement has never failed to check the worst flooded cellar when our simple instructions have been followed.

Eminent experts and Government tests have proved the safety, the ease and the economy of Pudloed Cement. Ask for the New Book of Tests (free).

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Ann's Gate, King's Lynn.

ROAD MAKING

REINFORCE CONCRETE ROADS WITH

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PORT TALBOT: Roadway [illegible] Co. by W. [illegible], Margam Park. Mr. William Jardine, Engineer.

THE EXPANDED METAL COMPANY, LTD.

(Patentees and Manufacturers of Expanded Metal.)

Head Office: YORK MANSION, YORK STREET, WESTMINSTER, LONDON, S.W.

Works: STRANTON WORKS, WEST HARTLEPOOL.

VICTORIA (Australia), January 12th. For the supply of steel rails and fishplates, for the Agent-General for Victoria.—Messrs. John Coates & Co., 115 Victoria-street, London, S.W.

Roads.

WEST SUFFOLK.—December 23rd.—For the supply of broken material (tarred and untarred), to be delivered at railway stations and sidings, for the county council.—Mr. W. Lionel Jenkins, county surveyor, Shire Hall, Bury St. Edmunds.

KESTEVEN.—December 25th.—For the supply of tarvia and for surface dressing with tarvia, for the county council.—Mr. W. B. Purser, Grantham.

HERTS.—December 27th.—For the supply of broken granite, slag, and tar-macadam required for the main roads, for the county council.—Mr. J. S. Killick, county surveyor, County Surveyor's Office, Hatfield.

SOMERSET.—December 30th.—For surface tarring on main roads at various places, for the county council.—Mr. Gordon R. Folland, acting county surveyor, County Surveyor's Office, Wells.

CANNOCK.—December 31st.—For the supply of refined tar prepared in accordance with the specification of the Road Board, for the urban district council.—Mr. R. Blanchard, engineer and surveyor, Council Offices, Cannock.

BRENTFORD.—January 1st.—For the supply of 12,000 gallons of distilled tar, for the urban district council.—Mr. J. W. Croxford, surveyor, Clifden House, Boston-road, Brentford.

ISLE OF WIGHT.—January 5th.—For the supply of 150 tons of 1½-in. granite, for the rural district council.—The Surveyor, Newport, I.W.

DORSET.—January 7th.—For the supply of broken granite, basalt, quartzite, limestone, and tar-macadam, for the county council.—Mr. E. H. Habgood, acting county surveyor, County Offices, Dorchester.

HERTS, January 31st. For the supply of hand-picked surface flints, dug gravel, hoggin, shingle, sand, and team labour, for the county council.—Mr. J. S. Killick, county surveyor, County Surveyor's Office, Hatfield.

Sanitary.

FAREHAM.—December 21st.—For house scavenging and emptying cesspools, for the rural district council.—Mr. L. W. Hunt, sanitary surveyor, East-street, Fareham.

KNARESBOROUGH.—December 21st.—For the removal of house refuse, for the rural district council.—Mr. W. Lupton, sanitary inspector, 14 Bower-road, Harrogate.

LOUGHBOROUGH.—December 21st.—For the removal of refuse, for the corporation.—Mr. H. Perkins, town clerk, Town Hall.

ISLE OF WIGHT.—December 22nd.—For the removal of house refuse, for the rural district council. Mr. H. E. Stratton, clerk, 30 Pyle-street, Newport, I.W.

LONDON. December 28th.—For the removal of refuse from car sheds and other depots, for the London County Council.—Chief Officer, London County Council Tramways, 62 Finsbury-pavement, E.C.

MUTFORD.—December 29th.—For the removal of house refuse and night soil, for the rural district council.—Mr. W. B. Forward, clerk, 148 London-road, N. Lowestoft.

Stores.

DOUGLAS.—December 27th.—For the supply of sundry stores, for the corporation.—Borough Surveyor, Douglas, Isle of Man.

OTLEY.—December 31st.—For the supply of setts, kerbs, flags, granite macadam, pitch, tar, slag dust, tar-macadam, limestone macadam, and brushes, for the urban district council.—Mr. C. F. Hodgson, surveyor.

Willcox's REQUISITES

of every description, including Pumps, Hose, Water Lifters, Jointing for Pipes, Valves, Specialities as illustrated, and Road-roller Stores . . . .

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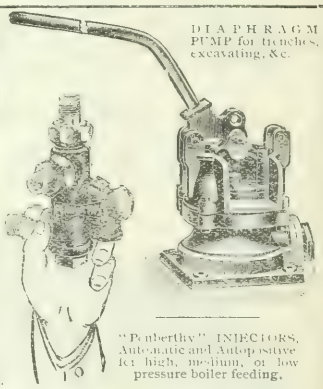

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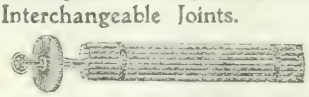

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The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. DECEMBER 24, 1915. No. 1,249.

Minutes of Proceedings.

To "Surveyor" Readers.

Once more is with us the season when we should be living in an atmosphere of geniality and peace on earth and goodwill to all men. But alas! the grim spectre War still walks abroad, and the air is full of farewells to the living and mournings for the dead. Not yet, then, is the time for the season's greetings in customary form. To our readers, nevertheless, we express our earnest hope that the Xmas of 1916 will find them blessed with health and strength to acclaim the triumph of our arms and the death of a ruthless and unscrupulous despotism.

Sewage Disposal by Aëration.

The extent of the usefulness of the Association of Managers of Sewage Works is not limited to its members alone, as the papers which are frequently read at its meetings are of the utmost value and interest to all engineers who have to deal with the disposal of sewage. Two such papers were presented at the recent annual meeting of this association, and one of them, by Mr. W. D. Scott-Moncrieff, was discussed in our issue of last week. The second paper, by Mr. W. H. Duckworth, F.C.S., manager of the Salford sewage works, which we print on another page, gives the results of further experiments in connection with the activated sludge process which have been carried out at his works, and we are glad to note that investigations into the continuous-flow method of operating this process have been included in this work. We recently printed some results which had been obtained with this method in America, and we are pleased to find that we were wrong in assuming that nothing had been done in this direction in this country. American engineers are evidently more prompt in publishing the results of their work than our own engineers, and it is certain that local authorities are much more willing and ready to give facilities for the trial of new developments and improvements in the disposal of sewage in America than in this country. On several occasions we have mentioned various details in connection with this method of sewage treatment, with regard to which more information was needed, and it is satisfactory to note that some of these have been investigated at Salford. For instance, it has been established that satisfactory results can be produced with open air-jets, although these need cleaning out at regular intervals. It has also been shown that a high degree of purification can be secured by much shorter periods of aëration than were previously considered necessary. The effect of an aëration period of as little as one hour was remarkable, and Mr. Duckworth believes that even less than one hour may be found to be sufficient when dealing with a purely domestic sewage, which is a great improvement on the original estimates of six-hour periods of aëration.

All the foregoing records refer to the fill-and-draw method of operation, but the results obtained under the continuous-flow system of working are also excellent, and we have to acknowledge that the claim that the principle of this practical method of operating the process in question has been established is fully justified. A high degree of purification was obtained when treating 60,000 gallons per day with an aërating tank of 12,000 gallons capacity and settling tanks of 3,000 gallons capacity, from which we infer that in the case of a separate system of sewerage the total capacity of tanks required for this process would be about one-quarter of the daily flow. No information is given as to the volume of compressed air required for the continuous-flow method, but it is probably just as well that this should be left to a later stage. As stated in the paper, the work at Salford has been carried on under the great disadvantage of having to use tanks which were designed for other purposes, and we believe it will be found possible to effect a considerable reduction in the volume of air required by modifications in the design of the aërating tanks, so as to secure the maximum oxidising effect from the air supplied. As suggested in these columns on previous occasions, we think it would be well worth while to conduct experiments with the view of ascertaining the relative efficiency of tanks of different depths, having due regard to the extra cost of compressing the air for the greater depths.

Another important point demonstrated by the experiments described by Mr. Duckworth is that the sterilising influence produced by trade wastes, which is the bugbear of sewage works managers in industrial districts, may be overcome in connection with this process by the use of an additional volume of air for a time. This is a valuable addition to our knowledge of the possible methods of meeting the difficulties which arise from the discharge of trade effluents into sewers. We do not know whether it is a practical suggestion, but it occurs to us that in a number of cases it might be more convenient to manufacturers to provide the necessary volume of compressed air for treating their wastes by the activated sludge process than to deal with them by chemical precipitation or settling tanks. On the whole, and having regard to the adverse conditions which have existed since the outbreak of the war, we think that Dr. Fowler and his colleagues must be satisfied with the progress which has taken place in the adaptation of the process which they introduced to practical working conditions, and we can only express the wish that further investigations may be carried out as rapidly as possible with the same thoroughness and success as in the past.

* * *

Engineering Colleges and the War.

The speech made by the Minister of Munitions in the House of Commons on Monday evening contained a reference to the use that has been made of the engineering college workshops in the work of speeding up the supply of munitions during the past few months. The record is a very creditable one, but, given a little more time and organisation, even more may be done in the future. The whole question was dealt with in a most able and exhaustive way in a paper read last Friday before the Institution of Mechanical Engineers by Dr. R. Mullineux Walmsley, principal of the Northampton Polytechnic Institute, London, and Mr. C. E. Larard, head of the civil and mechanical engineering department of the same institute. Once it is realised that the present gigantic struggle will be lost and won in the workshop, it will be seen that the part that can be played both practically and educationally by the engineering colleges is a very important one. The best use to make of any given college workshop depends on the equipment that is available. For example, in cases where a collection of modern tools of precision is available, together with other necessary tools, the workshop may well be used directly for manufacturing purposes. Other shops that are not so well equipped may be more usefully employed as training grounds for the semi-skilled workers.

But, as was pointed out in the paper to which reference has just been made, any attempt to undertake the manufacture of munitions at odd times during a regular full-time course of engineering college work is worse than useless. Those responsible for the colleges must realise that the sacrifice of purely educational work—and particularly that of a higher type—is the part that is demanded of them in the common cause. In writing thus, we do not mean to imply that there has hitherto been any disposition to withhold service of this kind. On the contrary, most of the London polytechnics and the technical institutions under the direction of the Education Committee of the London County Council are either directly engaged in the manufacture of munitions, or are giving some form of training to munition workers; and the same may be said of the engineering departments of the "modern" universities, and most of the provincial technical schools. The work of giving some instruction to members of the public, so as to fit them for semi-skilled operations, is a task of peculiar difficulty. In many cases the periods of training have been unduly short, while there has been a lack of that co-operation between the colleges and the works which is necessary to secure that the training shall be followed by employment. Since the paper was written a scheme has been drawn up by the Ministry of Munitions, in conjunction with other public departments, for securing the training of semi-skilled munition workers in technical schools. The Ministry lay special emphasis on the condition that the training to be given must be thoroughly practical, and that purely educational ideals must be subordinated to utilitarian methods. In fact, the training must be limited to cramming work in those processes upon which the pupil is to be employed when he undertakes practical work in the making of munitions.

* * *

Rural District Councils' Accounts.

In a circular issued last Friday the Local Government Board advert to sec. 58 of the Local Government Act, 1894, by virtue of which the provisions of sec. 247 (3) and (10) of the Public Health Act, 1875, are applied to the audit by a district auditor of the accounts of rural district councils, except so far as those provisions are modified by rules made by the board in pursuance of sub-sec. (3) of the first-mentioned section. The provisions of sub-sec. (10) of sec. 247 have already been modified in their application to the audit of these accounts by Rule 2 of the board's Order of May 20, 1895. With the view to economy, the board have issued an Order prescribing Rules for modifying or further modifying the provisions of sub-secs. (3) and (10) of sec. 247 of the Act of 1875, in their application to the accounts of rural district councils, and copies of the Order were on Friday sent to the clerks of rural district councils.

The effect of Article I. of the new Order will be to render it unnecessary for the rural district council to advertise in local newspapers any notice as to the date of the audit or the deposit of accounts. The duty of advertising in local newspapers notice of the time and place at which the audit of the accounts will be commenced will in future be imposed upon the district auditor, it being intended that he shall ordinarily include this notice in the notice which he now has to publish of the audit of the guardians' accounts. The clerk to the rural district council is, however, to give notice of the deposit of accounts, required by sec. 247 of the Act of 1875, by notices affixed in the place or places in the district where notices relating to the rural district council are usually affixed. The board suggest that this notice should usually be combined with that issued by the clerk to the guardians with respect to the audit of the union accounts. This Article of the Order does not affect any audit of which notice has been given, or for which arrangements have been made for the giving of notices in the manner prescribed by the enactments hitherto applicable. Article II. of the Order enables the rural district council, in lieu of the publication of an abstract of their accounts as required by the Order of 1895, to insert an advertisement in the local newspapers that the audit has been completed, and that the audited accounts and statutory financial statement will be open for inspection, without payment, by any parochial elector of a parish in the district.

* * *

Sanitation in Kimberley.

In an exhaustive report recently presented to the City Council of Kimberley, South Africa, Mr. James Dunn, the city sanitary inspector, discusses certain problems arising out of the present stage of development of the sanitary administration of the district. A perusal of the report at once impresses upon the reader the fact that large improvements have been effected in recent years, while an enlightened view is taken

in regard to modern questions. For example, experiments have been tried as to the suitability of a motor lorry for the work of refuse removal, but for financial reasons they did not justify its permanent use. This is not surprising when it is remembered that not only is animal haulage cheaper than in England, but that the expenses in connection with motor traction are about three times as heavy. In considering the question of motor transport in the future, Mr. Dunn suggests that tractors with trailers will be more useful than motor lorries. The advantage of such a system is that the tractors are constantly available for any desired service, while the trailers can be specially adapted for the particular loads they are intended to carry. Moreover, most of the time wasted in the loading of lorries would be saved, as the trailers when filled would merely await the arrival of the tractor.

Another matter upon which Mr. Dunn offers some excellent advice to his council is the fly nuisance. It appears that since 1912 the council has had power to make regulations for the prevention or abatement of conditions permitting or favouring the breeding of mosquitoes or flies, but that up to the present this power has not been exercised. In view of the indifference and ignorance that apparently prevail among the horse-keepers of Kimberley in regard to stable sanitation and the treatment of manure, Mr. Dunn proposes the institution of a system of licensing. But he also has the courage to point out that certain of the council's own institutions are also very much to blame in this connection. For example, in the market-house the method of dealing with the fly nuisance hitherto adopted has been the old-fashioned and inefficient one of catching and trapping. There is, however, no finality in this system, which aims at destruction rather than prevention. The problem is an acute one, for even if flies were not known to be the carriers of dangerous infectious diseases, their disgusting habits in connection with the food of man would alone warrant a vigorous and organised attempt at their extermination.

* * *

"Economy" and Public Scavenging.

The medical correspondent of the *Times* has written a word in season on the subject of administrative economies. Economy of expenditure is, of course, very essential in these exceptional times, but it is the merest truism that there are departments of municipal administration in which the exercise of economy ought to be approached with great circumspection. One of these, as the writer points out, is concerned with the work of cleansing and scavenging. The writer urges that if saving on scavenging means collecting refuse from dwelling houses less often than it is collected at present, the sooner the matter is taken in hand the better. All the fly campaigns in the world, he adds, will not rid us of the pest so long as dirt and rotting materials are left about to wait for the dust-cart, which comes only twice or thrice a week. The article is made use of as a peg on which to hang a forcible plea for the daily collection of refuse, and incidentally the practice followed by the City of Westminster is the subject of high commendation. There the whole of the dusting is done daily, and it is argued that what Westminster has done can be done by the rest of the metropolitan authorities, though there is none which has so far adopted the system. Expense is not the reason for this, for Westminster is cited as an example of the economical collection of dust.

There is no doubt that this is a subject of the highest importance in so far as national health is concerned, but it does not appear that there is a sufficient body of public opinion either in London or the Provinces on the side of an improvement of public cleanliness. The evidence is, indeed, just the reverse, for we read of protests by urban and rural communities against proposals for scavenging. In the Lutterworth Rural District quite recently a reverend gentleman elected to be the spokesman on behalf of a number of parishioners who were indignant that the rural council should enter into scavenging contracts, and had assumed almost a hostile attitude with respect to the matter. At Sowerby also the chairman of the urban council expressed himself as strongly opposed to a new scheme of public scavenging, and a request was made that the matter should be deferred until a later period. So much is constantly heard about the cost of scavenging schemes, while at the same time the dangers arising from neglected sanitation are disregarded, that we welcome the warning by the medical correspondent of the *Times* as being particularly opportune. As he very cogently expresses it, the most wasteful "economy" of all is that which sacrifices benefits of vital importance for the sake of trivial sums of money.

* * *

Municipal Politeness.

In our correspondence columns there appears, under the heading "Municipal Politeness," a letter in which the writer makes a complaint of a kind with which we are only too familiar, namely, a failure on the part of a local authority to give any acknowledgment to the unsuccessful candidates for an appointment for which applications have been invited by advertisement. In most public offices of repute every letter, whatever may be its subject, receives a courteous formal acknowledgment, and we see no reason why an application for an appointment, which is prepared at considerable trouble and expense for the mutual benefit of the applicant and the authority, should be made an exception to this rule. In the particular case referred to by our correspondent, there is even greater cause for complaint than is usual, inasmuch as applicants were specifically informed that they were at liberty to send copies of their applications and testimonials to the members of the council, if they chose to do so. In these circumstances every serious candidate would, of course, feel obliged to go to this expense. Nevertheless, it appears that the council concerned were unwilling or unable to afford the necessary sovereign or so to acquaint each candidate with the result of his application. We have always taken the view that this courtesy should be extended to all applicants for municipal appointments; and further, that it should be done through the medium of a sealed letter, and not by means of a postcard, which is in reality an open announcement of failure.

Tar-spraying: County Council Contributions.—At the last meeting, Llantrisant Urban District Council had before them a letter from the Carnarvonshire county surveyor, Mr. Evan Evans, stating that the county council had had several discussions on the subject of what contribution to pay in respect of tar-spraying the roads. The amount hitherto contributed by all urban authorities was one-third of the cost, and this seemed to be based on the findings of the Local Government Board in arbitrations where the question of palliatives for the allaying of dust had arisen. The county council was not responsible for contributing more than what was necessary for the maintenance of roads, and was not responsible for paying anything on roads which was mainly sanitary, or for the benefit of the inhabitants of a town as against those that passed through the town. Tar was a palliative mainly for allaying dust and for the benefit mainly of people who lived on the side of the road, and, moreover, the Road Board and the Local Government Board had apparently decided that tarring was an improvement apart from maintenance. If the county council choose they need not contribute anything towards improvements. A member contended that tar on the road was not a palliative but a preservative. Rural councils were repaid the whole of their outlay on tar, while urban councils received only one-third.

The Activated Sludge Experiments at Salford.*

By W. H. DUCKWORTH, F.C.S., Manager, Salford Sewage Works.

The progress of science and the practical application of science are probably the predominating features of the era in which we live. Not among the least of those scientific conceptions which give promise of being of a far-reaching character and of universal application are those on the treatment of sewage by means of aeration, which were formulated in the laboratory of the Manchester sewage works, and which have been published by Messrs. Ardern and Lockett during the last two years in the "Proceedings" of this association and in the journal of the Society of Chemical Industry. The subject has been prominently before the sewage world during this time, and most individuals interested in the disposal of sewage are cognisant of the general principles involved. The author read a paper before the Manchester section of the association some thirteen months ago† detailing the experimental work which had been done at the Salford sewage works on the disposal of sewage by these means, and the object of this paper is to record the continuance of those experiments, and by the publication of the results further to establish the reliability of the methods, and the general stability of the principles actuating them.

The former paper dealt with the experiments which had been done up to the end of October last year, and while the possibility of treating sewage by means of aëration had then been proved, there remained, of course, many points on which information was both desirable and necessary, and which only time could reveal. For example—(1) Three hours was the lowest time in which a finished result had been obtained. Could this time contact be further curtailed? (2) The system had not had a trial through the winter. Could the results of summer and autumn be substantiated through the cold weather? (3) The method of aëration was with open jets. Would these get clogged, and what period of time would elapse before this occurred? (4) Could the quantity of air required be curtailed by modifications in the tank bottom? (5) Was "continuous flow" a possibility? (6) That most important question of all. Is the whole method an economic possibility?

All these questions was before us thirteen months ago. We desired to obtain information on all of them, but the great European War which has overshadowed everything in this half of the globe, has very effectually precluded us from making that progress with these investigations which under normal conditions we should have been able to make. Fifty per cent of our men have joined H.M. Forces, or gone on munition work, and the general inability to obtain anything in the way of machinery or castings, because of munition requirements, has been a very substantial bar to our progress. Some information, however, we have been able to obtain, and the above phases of the subject may perhaps best be dealt with in the order named.

May I here just recall the type of tank, and the method of distribution of air along the bottom of the tanks in which the experiments have been made? Two sections of a tank, each 90 ft. long by 9 ft. wide and about 4 ft. 6 in. deep, and each having a capacity of about 22,000 gallons, were fitted as follows: A 12-in. cast-iron pipe brings air from the air engine, and has a 12-in. branch carrying the air to the bottom of the tank, and from this branches east and west horizontal 9-in. pipes, which are further reduced to 6-in., and finally to 4-in. These constitute what may be called the main delivery, and on each side of this main, and at right angles to it, are 2-in. pipes with tapering side branches fitted with ¾-in. brass jets in one case, and with ¾-in. brass jets without side branches in the other, for the distribution of air.

Fill and Draw.

The tanks are filled and emptied by syphons, and have been practically in continuous use on the fill and draw method the whole of the time. The cycle of working has been as follows: Filling (the blowing also taking place during filling), blowing, lying quiescent, and running off. The time of filling has, with few exceptions, been one hour in each tank; blowing, various times from three hours to one hour; lying quiescent, two hours, and later, one and a-half hours; running off, one hour.

The general results were so encouraging with the three-hour period of blowing that there was no hesitation in reducing this to two hours. This was continued for several weeks in succession, and the results were very good. A large number of analyses have been made by our chemist, Mr. S. E. Melling, F.I.C., county analyst for Cheshire, and the following are the average results in grains per gallon:—

Two Hours Blowing.

	No of samples analysed	Highest figure.	Lowest figure.	Average.
Free N.H. crude sewage	88	7·0	·27	1·7
,, ,, effluent	108	2·05	nil	·33
Alb. N.H. crude sewage	88	·585	·18	·42
,, ,, effluent	108	·29	·06	·12
4 hrs. oxg. crude sewage	88	33·3	1·04	6·0
,, ,, effluent	108	13·73	·07	·94
Nitrates in effluent	108	1·18	·05	·485
Temperatures crude sewage	43	74	51	65
Percentage Purification	—	—	—	—
Alb. N.H.	—	87 per cent.	27 per cent.	71 per cent.
4 hours oxg.	—	97 ,,	45 ,,	84 ,,

The above figures speak for themselves, and in explanation of the abnormal figures of 13·73 oxygen absorption in a final effluent, it must be understood that we have some 3,000,000 to 4,000,000 gallons of trades waste per day, and that a considerable portion of this is from tar distillation and ammonium sulphate works, and that this trades waste comes to the sewage works in large quantities without warning, and at any time to suit the manufacturers' convenience, day or night. Abnormal oxygen absorption figures, with a corresponding poor effluent, are therefore easily understood. As no bacterial life can withstand the action of strong sterilising agents, all systems of sewage purification, or rather the various modifications of sewage treatment in general use, would suffer similarly; but it is our experience that, under these conditions, the activated sludge very quickly regains its efficiency, and it only needs a little extra blowing to be able to again get normal results from a normal sewage. For example, we had the above sample of a sewage showing 34·3 grains per gallon oxygen absorption on February 1, 1915. The effluent from this particular sample was 1·04, showing an approximate purification of 97 per cent; the next filling was crude sewage, 13·26; effluent from this, ·71, showing 94 per cent purification; but a little later it was necessary to increase the time of blowing to four hours for two fillings only, after which the former two hours' aëration was resumed. On September 21, 1915, the four hours' oxygen absorption was 23·58, giving the above enumerated effluent of 13·73 in No. 1 section and 4·00 in No. 2. Blowing was then increased to four hours

* Paper read at the recent annual meeting of the association of Managers of Sewage Disposal Works.

† See The Surveyor, December 11, 1914.

[illegible] and the recuperation is [illegible]

To sum up this phase of our experience extending over the last twelve months on the "fill and draw" method,

4 HOURS OXYGEN ABSORBED—results in grams per gallon).

Crude sewage.	No. 1 section.	No. 2 section.	Crude sewage.	No. 1 section.	No. 2 section.	Crude sewage.	No. 1 section.	No. 2 section.
1·573	[illegible]	2·07	2·41	1·33	1·45	1·42	1·20	·84
Percentage purification	[illegible]	[illegible]	—	94	93	—	91	94

In addition, the effluents were bright and clear, and a very complete clarification had taken place in most of the samples, the suspended matter showing only the slightest traces.

ONE AND A-HALF HOURS' BLOWING.

The period of aëration was later reduced to one and a-half hours, and the results obtained were quite [illegible] preceding. The following table gives the average results obtained during this [illegible]

we conclude that the time of aëration can assuredly be cut down to one-third of what was possible a year ago. This would, of course, cut down cost in the same ratio. And the remarkable clarification, approaching drinking water clarity, which has often been obtained during holiday times and on Sundays, times when many works are shut down, and therefore not giving us the doubtful benefit of their trades waste, indicate that with a domestic sewage only the results obtained would work out at a still higher percentage purification than those I have tabulated.

	No. of samples analysed.	Highest figure.	Lowest figure.	Average.
Free N.H. crude sewage	76	4·8	·65	2·11
" " effluents	105	2·25	nil	·41
Alb. N.H. crude sewage	76	1·05	·11	·749
" " effluents	105	·84	·06	·12
4 hours oxy. crude sewage	76	20·25	1·45	7·24
4 " " effluents	105	2·75	·39	·78
Nitrates in effluent ...	109	·08	nil	·001
Percentage purification				
Alb. N.H.	—	·92	·55	·84
4 hours oxy.	—	·96	·60	·84
Temperatures crude sewage	43	76 Fahr.	58 Fahr.	64 Fahr.

[illegible] their own story. It must be recorded that the samples, with few exceptions, were well clarified, the flocculation of the colloidal matter being generally very complete, and suspended matter showing only minute traces.

ONE HOUR'S BLOWING.

We then adopted the lowest period of aëration that [illegible]

and I venture to express the opinion that the time could be further reduced.

The figures given under the head of two hours' and one and a-half hours' aëration cover the coldest portion of the year, and the lowest recorded temperature of crude sewage treated was 51 deg. Fahr., on December 27, 1914. It may be noted also that the proportion of activated sludge was lower about this period than later on in the experiment, in consequence of 5 in. of sludge being removed from No. 2 section with which to inoculate No. 1.

	No. of samples analysed.	Highest figure.	Lowest figure.	Average.
Free N.H. crude sewage	40	3·45	·16	1·79
" " effluents ...	72	2·05	nil	·615
Alb. N.H. crude sewage	22	1·05	·20	·569
" " effluents	36	·30	·10	·142
4 hours oxy. crude sewage	22	13·25	2·25	6·87
4 " " effluents	36	1·25	·60	·86
Nitrates in effluents ...	36	·050	·005	·020
Percentage purification				
Alb. N.H.	—	·84	10	75
4 hours oxy.	—	·92	53	88
Temperatures crude sewage	11	75 Fahr.	62 Fahr.	68 Fahr.

The above figures do not differ very materially from the two previous tables representing the two hours' and one and a-half hours' aëration respectively. The general appearance of the effluents was slightly opalescent, though a number of them were quite clear. It may be noticed that the oxidation, as indicated in the nitrates figures, is a diminishing quantity when compared with the results of the longer period of aëration, this, of course, indicating that with our sewage this one-hour period was approaching the irreducible minimum, and I would here draw your attention to the column in the several tables indicating the number of samples which have been analysed, and on which the various averages have been calculated, and the opinions herein expressed, based. The variation in the numbers shown under that heading is due to alteration at various times in filling, because in filling both sections [illegible] crude sewage [illegible] common to both, and in the calculations was used accordingly; but in all the figures tabulated the results are on the whole number of determinations made under the various items of the analyses.

During the months of December and January, the period when the proportion of sludge was lowest, our tanks containing something under 20 per cent, the periods of blowing varied in the two sections from two hours to six; but No. 2 section was kept on two hours' aëration until January 18, 1915, when the period was changed to four hours until February 2nd on account of the appearance, in considerable quantities, of trades waste of a sterilising nature. On the last-named date two hours was again reverted to and continued until February 22nd, when the time was cut down to one and a-half hours, and it thus continued until the end of April, when it may be considered cold wintry weather is at an end.

The method of aëration has throughout been with open jets, and as up to November last year they had only been in operation on this system for some five months, we were anxious to know how long they would open be before choking took place, for it must be remembered that they are in the bottom of the tank, and that during the quiescent and running off period they are open to the sludge in its densest condition. Our Nos. 1 and 2 sections were cleaned

with small steel pointers and put in operation again on December 8th last year, and while they have worked practically continuously since then, and are still giving good results, they have never since that date been empty, nor in any condition in which anything of the nature of these pointers could be used to open out any of the jets that had become clogged. True, many of these jets are now stopped up, probably 90 per cent of them in No. 1 section, and something less than that in No. 2; but the results in these sections with a little extra blowing are still good, and would pass the standard of the latest Royal Commission's recommendations, or, in our own particular case, those of the Mersey and Irwell Joint Committee. The choking of these jets after some nine to twelve months' use, considered in connection with the results obtained, lead one confidently to think that the amount of air required to effect efficient purification is a great deal less than we have used in our attempts to solve the problem so far, and justifies us in assuming that modifications of the tank bottom using a much smaller number of jets would bring about similar results with a correspondingly less quantity of air.

The following table shows the average analyses of activated sludge samples from December, 1914, to April, 1915 (inclusive), and cover the operations which would come under the head of cold weather:—

AVERAGE ANALYSES OF ACTIVATED SLUDGE SAMPLES FROM DECEMBER, 1914 TO APRIL, 1915 (INCLUSIVE).

—	Percentage.	No. of samples.
Nitrates in effluent	·631	203
Free N.H. crude sewage	1·88	195
,, ,, effluents	·291	207
Alb. N.H crude sewage	·430	195
,, ,, effluents	·166	207
4 hrs. oxg. crude sewage	5·42	195
4 ,, ,, effluents	·78	207
Percentage purification ..	—	—
Alb. N.H.	76	207
4 hrs. oxg.	88	207

The next table shows the average monthly results from December, 1914, to October, 1915 (inclusive), and is a comprehensive summary of the whole results on the "fill and draw" method for this period.

A little explanation may here be offered as to why the results in No. 1 section are not so good as those in No. 2: In May a 12-in. feed pipe was substituted for a 4-in. one, with the object of facilitating the fillings. But the suction end of this pipe dipping too far down in the silt pit drew a large amount of more or less septic sludge from the bottom, and this was delivered in the aërating tank, with the result that the activated sludge already in the tank could not effect purification, the effluent being little better than the crude sewage. This, however, was again overcome by prolonged blowing, and results were soon normal again. But the effect of this detritus is shown in the number of jets that are now stopped up. From this time onward less and less ebullition was observable at the surface, and at the present time an area in the vicinity of the delivery of this sludge, a section some 15 ft. by 9 ft., shows no air outlet whatever, and we have reason to think that but for this accident the aëration would still be general all over the tank.

CONTINUOUS FLOW.

In December, 1914, we made an attempt to "prove the principle" of continuous flow, using the tank in which we made our first experiment on the "fill and draw" method, and which is of about 12,000 gallons capacity, using two other tanks each holding about 5,000 gallons as settlers, the three being used in series. Sewage was run in through a 2-in. pipe from the main channel, and the results for several days led us to think that the method was possible, but finding at the end of nine or ten days that the activated sludge had left the aërating tank and lodged in No. 1 settler, a condition we had previously surmised would happen, the experiment had to be temporarily abandoned pending the provision of a small pump to send back the sludge. Owing to the exigencies of the war, it was many months before this pump could be installed, and in the meantime several alterations in the design of the tank and settlers were made. Early in October this year we again essayed to prove the possibility of continuous flow, using the design of tank as shown on the diagram. The tank is about 50 ft. long, 9 ft. wide, and 4 ft. 6 in. deep, and air is passed in as in the case of the "fill and draw" experiments.

AVERAGE ANALYSES OF ACTIVATED SLUDGE SAMPLES FROM DECEMBER, 1914 TO OCTOBER, 1915.

	December.		January.		February.		March.		April.		May.		June.		July		August.		September.		October.		Grand average	
	Per-centage	No. of samples.	Per-centage.	No. of samples.	Per-centage	No. of samples.	Per-centage.	No. of samples.	Per-centage	No. of samples.	Per-centage	No. of samples.	Per-centage	No. of samples.	Per-centage	No. of samples.	Per-centage	No. of samples.	Per-centage	No. of samples.	Per-centage	No. of samples.	Per-centage	No. of samples.
Nitrates in effluent ...	·00	47	·847	44	·632	36	·554	42	·354	34	·632	37	·215	32	·355	40	·293	14	·182	44	·526	4	·487	354
Free N.H. crude sewage ...	1·48	47	1·67	44	1·78	36	2·12	44	2·96	24	2·25	16	1·79	11	1·52	17	1·77	25	1·74	22	2·59	2	1·91	288
,, ,, effluents ...	·246	47	·343	44	·958	36	·502	44	·488	36	·345	27	·447	22	·225	38	·629	50	·485	44	·945	4	·412	392
Alb. N.H. crude sewage ...	·324	47	·371	44	·971	36	·336	44	·757	24	·528	16	·536	11	·187	17	·547	7	·765	22	·870	2	·501	270
,, ,, effluents ...	·085	47	·087	44	·091	36	·126	44	·127	36	·150	27	·138	22	·119	38	·129	14	·170	14	·120	4	·122	336
4 hrs. oxg. crude sewage ...	2·65	47	4·74	44	6·68	36	5·81	44	7·86	24	7·81	16	7·87	11	6·48	17	7·34	7	11·93	22	5·94	2	6·76	270
4 ,, ,, effluents ...	·58	47	·69	44	·75	36	·72	44	·65	36	·93	27	1·04	22	1·16	38	·79	14	1·47	44	·90	4	·96	356
Percentage purification ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Alb. N.H.	74	47	77	44	78	36	64	44	84	36	72	27	75	22	76	16	77	14	78	44	76	4	75	331
4 hrs. oxg.	72	47	86	44	89	36	86	44	92	36	89	27	87	22	84	16	90	14	88	44	85	4	86	334
																								2,964

The sewage is delivered in a wooden trough with V notches cut to the bottom, and placed just above the surface of the water in the tank. Four wooden barriers were placed equidistant in the tank, and about 2 ft. from the bottom, in such a way as not to allow any sewage to pass over the top or past the sides, but to lead all underneath. In this way it was hoped to obviate any "short cuts" of the incoming sewage to the outlet, and, judging from the results, it seems to have been effectual. At the end of the aërating chamber there is a slope from just below the outlet cill to the bottom, a small area allowing a little quiescence before the sewage and sludge reach the first settling chamber. These are four in number and placed in series, and are in the form of an inverted cone, with a board leading the effluent from the last tank to within 18 in. of the bottom, following the form of the tank, and about 6 in. from the side. A small scum board dipping about 1 in. below the level and in front of the weir in each case is fixed to deviate as far as possible the passage of fat or other particles of floating matter. The total capacity of these four settling tanks is approximately 6,000 gallons, or about 1,500 gallons each. A pump is fixed near these settlers, with a suction fitted with foot-valve in each of them, and the delivery is at the end of the aërating chamber, so that sludge pumped back shall join the incoming sewage.

Since the beginning of this experiment two months ago we have tried the method on various quantities of sewage. It will be understood that a change from one daily quantity to another some time was lost on each occasion in adjusting things generally. We had also some mechanical difficulties in connection with our pump. The first attempt was on some 33,800 gallons per day, which was all the 2-in. feed pipe would bring, and after adjustment samples were taken for analyses. The following table represents the average analyses over several days:—

—	No. of samples.	Highest.	Lowest.	Average.
Nitrates in effluent	33	·905	·330	·632
Free N.H. crude sewage	17	3·75	·800	1·83
,, effluents	34	1·60	nil	·50
Alb. N.H. crude sewage	17	1·20	·220	·646
,, ,, effluents	34	·160	·08	·113
4 hrs. exg. crude sewage	17	16·64	2·45	8·37
4 ,, ,, effluents	34	1·14	·62	·87
Temperature of air	7	65 Fahr.	60 Fahr.	62 Fahr.
,, sewage entering	7	74 ,,	69 ,,	71 ,,
,, fourth settling tank	7	66 ,,	60 ,,	63 ,,
Percentage purification	—	—	—	—
Alb. N.H.	44	90	30	78
4 hrs. exg.	34	95	54	87

33,800 Gallons. October 10th, 11th, 12th and 13th.

On October 15th the 2-in. syphon pipe feed was changed for a 3-in. one, and after adjusting the quantity treated to approximately 50,000 gallons daily, the following average results were obtained:—

—	No. of samples.	Highest.	Lowest.	Average.
Nitrates in effluents	91	·780	·032	·360
Free N.H. crude sewage	16	1·00	·80	1·83
,, effluents	91	1·80	·01	·40
Alb. N.H. crude sewage	16	1·50	·300	·640
,, ,, effluents	91	·240	·08	·121
4 hrs. exg. crude sewage	62	15·72	2·56	7·97
4 ,, ,, effluents	123	1·35	·50	·83
Temperature of air	16	58 Fahr.	49 Fahr.	55 Fahr.
,, sewage entering	16	70 ,,	62 ,,	66 ,,
,, fourth settling tank	16	64 ,,	52 ,,	59 ,,
Percentage purification	—	—	—	—
Alb. N.H.	91	95	53	78
4 hrs. exg.	91	95	76	89

50,000 Gallons. October 19th to November 10th.

On November 10th the quantity passing through was increased to 60,000 gallons daily, and the table on next page shows the average results over the several days.

The method of sampling adopted was as follows: For several weeks samples of crude sewage were taken every hour, and these at the end of four hours were made into one sample. The same procedure was adopted with regard to the effluents, but in later analyses we are taking the samples every hour, as before, but making twelve of each into one grand sample, thus broadening the average and reducing the number of determinations made. This has become necessary because of the increase in the work of the laboratory, the number of analytical determinations covered by this paper being over 3,000 during the year, which, with a depleted staff, and in addition to the ordinary routine work, has kept this department of our place very busy.

The method of returning the sludge to the aërating chamber on this "continuous flow" is important from the point of view of the efficiency of the system, as well as the cost. Those who are acquainted with activated sludge know that it is a well-flocculated substance which settles readily, and leaves a line of demarcation between sludge and supernatant liquid as clear and well defined almost as mercury and water. This property of rapid settlement is well shown in this experiment. We have four settling tanks, and the whole of the effluent flows through these, but the first two are generally sufficient to give us all the settlement required, and while when treating the larger quantity of sewage we pump the bulk of the settled sludge from these two, back to the beginning of the aërating chamber, each for five minutes per half hour, the remaining two only require pumping back for about two minutes per week; usually there are only a few inches of sludge at the bottom of these conical tanks at the end of a week's working. This means that, with an aeration tank of 12,000 gallons, a settling tank of 3,000 gallons is sufficient, or one quarter of the capacity of the aërating tank. This we consider is an important point ascertained, and this result may easily be surpassed by others in later experiments with variations in design.

It has been our practice to ascertain daily the amount of sludge present in the aërating chamber. Five samples are taken in the space of a minute at five points in the length of the tank, about equidistant from each other; these are allowed to settle in graduated cylinders for two hours, and then read off, this reading being taken as the percentage of sludge with which we are working. We have our best results when working with 20 to 25 per cent of sludge, and the excess is usually pumped to the drying area from the first and second settlers twice per week.

Briefly summarised, our experiments may be said to have "proved the principle" on both the "fill and draw" and the "continuous flow" methods. They have shown that this purification is possible by aëration with open jets, and that air in much lesser quantities than was at first used is necessary. They also indicate that results may be expected in winter as well as in summer, and that the influence of sterilising substances which play such havoc with bacteria beds generally can readily be overcome.

They indicate that a domestic sewage will be a comparatively easy problem, and that with a well-designed scheme a number of the difficulties we have had to deal with would be unknown. They have demonstrated the tractable nature of the sludge which has to be dealt with at all works, and indicated the proportion of settling tank or tanks to aërating tank in the "continuous flow" method, and many minor details which may be characterised as "observations." This work has been prosecuted since its inception with this idea predominating—that the system must justify itself by its own inherent qualities, and stand or fall by its own virtues. It has been tested on a crude sewage, not very effectively screened, and with little detritus settlement, and containing large quantities of trades waste, and the results may be said to have been obtained under somewhat adverse conditions.

One or two other phases of our experiment may be dealt with in a few final words. We hoped a year ago that we should have had at this time further

60,000 GALLONS. NOVEMBER 11TH TO NOVEMBER 18TH

	No. of Samples.	Highest	Lowest.	Average
Nitrates in effluents	16	·492	·065	·172
Free N H. crude sewage	8	1·95	·850	1·51
,, ,, effluents	16	1·20	·47	·785
Alb. N.H crude sewage	8	·700	·325	·557
,, ,, effluents	16	·180	·10	·140
4 hrs oxg crude sewage	8	9·04	7·15	7·82
4 ,, ,, effluents	16	1·02	·74	·85
Temperature of air	2	47 Fahr.	25 Fahr	38 Fahr.
,, sewage entering	2	64 ,,	63 ,,	63·5 ,,
,, fourth settling tank	2	57 ,,	55 ,,	56 ,,
Percentage purification		—	—	—
Alb. N.H.	16	83	44	74
4 hrs. oxg	16	92	83	90

information respecting the disposal of the excess sludge, but of necessity this has had to be temporarily abandoned for reasons already given. Many of you will no doubt be disappointed when I offer you no information with regard to the cost of treatment. The reasons already adduced must also serve at the present time. We should without doubt have made much more progress, and should have obtained data on this most important question—namely, the economic possibility of the treatment of sewage by activated sludge—but for the general dislocation due to the war; and as I would rather disappoint than mislead, I would much prefer to leave anything in the nature of speculation entirely alone until facts have been obtained on a fairly large scale to give us something definite to work upon. Suffice it to say that we are still working with plant designed entirely for something else, and which has been adapted with the object of first "proving the principle" on both the "fill and draw" and "continuous flow," and which I think, in the face of results obtained, must be conceded; and I would here express the hope that, as the subject is full of possibilities, sewage works managers, chemists, civil and mechanical engineers, and others in touch with and interested in the disposal of sewage, will make it an object of study, experiment and research.

I am indebted to our chemist, Mr. Melling, for his interest and help, and much personal attention which he has, and is, showing in these experiments, and I take this opportunity of thanking the chairman and members of the River Irwell Conservancy Committee of the Salford Corporation for the interest they also take in the matter, and for permission to publish these results.

Extraordinary Traffic.—Will "Anxious," queries by whom under this heading were answered in our "Law Notes" of the 10th inst., and whose name and address we have mislaid, kindly communicate with the Editor?

Chard Borough Surveyor and Military Service.—The borough surveyor of Chard, Mr. E. W. Hearn, wrote to the town council stating that he proposed to join the group system under Lord Derby's scheme, and the matter was discussed at the council meeting recently. A suggestion that part of his salary should be paid was objected to on the ground of economy, and it was moved and seconded that the borough surveyor be granted leave of absence and his place kept open for him. In the course of the discussion Alderman Gawler said that even the scavengers employed in the City of London were treated better than they were proposing to treat Mr. Hearn. The motion as proposed was eventually carried.

DRY-POWDER CHEMICAL FIRE EXTINGUISHERS.

On Monday, in the House of Commons, the Home Secretary was asked by Mr. Denniss whether the Home Office had forbidden the Press (through the Press Bureau) to publish anything likely to promote the sale of dry-powder chemical fire extinguishers, on the ground that they were unreliable for controlling fires such as were likely to be caused by bombs; whether he was aware that, apart from fires that had got serious hold on buildings, such extinguishers were largely used as effective first-aid fire extinguishers for ordinary fires not caused by bombs, especially in the larger-sized houses in town and country; and whether it was the policy of the Home Office to prevent the sale of such first-aid fire extinguishers.

Sir J. Simon said the warning referred to was issued because the claims put forward by the makers of certain of these dry-powder extinguishers were likely to mislead the public into believing that such appliances could be relied upon in preference to water as a means of extinguishing or controlling incendiary bombs and the fires caused by them. The Commissioner of Police had investigated the matter with the aid of a committee of experts who represented the Admiralty, the War Office, the Home Office, the Police and the Fire Brigade, and on September 18th issued a public notice to the effect that experiments so conducted were found to show that powder extinguishers were ineffective as compared with water for dealing with the fires in question; and that the danger of serious damage being caused by such fires would be greatly increased if the public relied on these appliances.

Mr. Denniss: If they disclaim any right to advertise in regard to putting out fires caused by incendiary bombs and limit the advertisements to their present useful purpose, will the right hon. gentleman allow their advertisements to appear again?

Sir J. Simon: I do not think that any prohibition has been issued, but rather extravagant advertisements are to be deprecated, especially in cases where a panic might be caused if a bomb were dropped.

ECONOMIES IN LOCAL ADMINISTRATION.

PROPOSAL FOR LONDON CONFERENCE.

In the House of Commons on Monday the President of the Local Government Board was asked if he would consider the advisability of calling a conference of representatives of all local authorities in the London area with a view to effecting economies in the cost of administration.

Mr. Hayes Fisher, who replied, said the President of the Local Government Board used every endeavour to promote economy in the cost of local administration, but was not sure that the suggestion was one which would be likely to give very satisfactory results in practice. If, however, the President of the Board had evidence of a general feeling that such a conference would be of advantage, he would be glad to do anything in his power to bring one about.

Disposal of Waste Paper.—The Local Government Board are suggesting to borough councils that paper and cardboard house refuse might be sold to defray to some extent the cost of collection. The board doubt whether it is advisable to require householders to burn such material in all cases themselves. Kensington Council regard the suggestions as impracticable and uneconomical.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

COUNCIL MEETING.

A meeting of the council of the Institution of Municipal and County Engineers was held at 92 Victoria-street, Westminster, S.W., on December 10th, the president being Messrs. H. T. Wakelam, president, in the chair, W. N. Blair, H. Percy Boulnois, H. W. Bowen, Chas. Brownridge, E. E. Wallington Butt, G. F. Carter, J. W. Cockrill, P. Dodd, Ernest J. Elford, H. Pearson Foster, W. Haspar, T. W. A. Hayward, W. F. Lancashire, Ernest B. Martin, Frank Massie, P. H. Palmer, L. S. Pickering, Lewis Reservoire, Norman Scorgie, W. J. Steele, Henry E. Stilgoe, R. J. Thomas, James A. Webb, Charles F. Wike, Edward Willis, the consultant secretary, and the secretary.

THE MEMBERSHIP ROLL.

Mr. W. N. Blair reported that at a meeting of the General Purposes Committee held that day it was resolved to recommend Mr. G. F. Paget, deputy engineer and surveyor to the Gainsborough Urban District Council, for election to associate membership, and Mr. S. Dixon, assistant engineer to the Grimsby Rural District Council, for election to studentship.

THE LATE MR. E. DIXON.

The death of Mr. E. Dixon, Stockport, Welsh was reported to the committee, and it was resolved to [illegible] to the relatives.

EXAMINATION APPLICATIONS.

It was resolved to recommend that permission to [illegible] examinations be granted to Messrs. J. Costello, E. D. Robertson, and C. Wilson.

INSURANCE FOR WAR DAMAGE.

The secretary reported receipt of an invitation to support the petition to the Prime Minister. It was resolved to recommend that, as the question is not one affecting the interests of the institution, no action be taken.

THE [illegible] AND MILITARY SERVICE.

The position of the secretary, in view of Lord Derby's scheme for recruiting, was considered, and it was resolved to recommend that the council place no obstacle in the way of the attestation of the secretary. It was further resolved to recommend that from the date Mr. Robinson is called up for military service Mrs. Robinson be appointed secretary (pro tem.) during his absence, and that she be paid the same salary as that now received by her husband, and that from such date the salary of Mr. Robinson do cease.

TAXATION OF SURVEYORS' MEANS OF LOCOMOTION.

The secretary reported that, on the instructions of the president and chairman of the General Purposes Committee, he had sent the following letter to the Chancellor of the Exchequer:

"I am directed to represent respectfully to you the hardship suffered by engineers and surveyors engaged by local authorities to carry out the work of constructing and maintaining the roads of the country by their having to pay the motor spirit duty and local taxation licence duty in respect of petrol used solely in travelling over the districts in which the roads they have to maintain are situate, and to enable them to superintend the maintenance and repair of such roads.

"It may be argued that such taxation is borne by the local authorities, but in many cases a fixed allowance for travelling is made, with the result that the more energy and attention engineers and surveyors give to their work, the more they have to pay in taxation. At the present time, owing to the loss of staff and the increasing difficulty of maintaining the roads in a proper condition with reduced funds, it is more than ever necessary for the engineers to be able to utilise the speediest possible means of locomotion for the purpose of carrying out the necessary supervision and inspection.

"In these circumstances I am to urge that such engineers and surveyors should be relieved of the payment of such duties, for which there are the following precedents:—

"(1) Under sec. 36 of the Highway Act, 1862, highway surveyors were exempt from paying tolls.

"(2) The relief granted to physicians and surgeons and proposed to be granted to veterinary surgeons under the Finance Acts.

"(3) Inland Revenue officials are exempted from payment of licence duties.

"(4) Under the Locomotives Act exemption is given from payments for steam rollers.

"(5) Omnibuses applying for hire pay half the motor spirit duty on the petrol consumed, and reduce their charges still further in this direction by using diluted spirit.

"I am to express regret that it has been found necessary to raise this question at the present time, but my council feels that it is exceedingly undesirable that officers who are engaged on work of so great national importance as the maintenance of the roads of the country should be hindered in making their work as effective as possible by the taxation of material used in providing such locomotion as will enable them to apply their time and attention most usefully and economically."

It was resolved to recommend that the secretary's letter be approved, and that he be instructed to seek support from the County Councils Association, Association of Municipal Corporations, Rural District Councils Association, and other similar bodies.

MEETING.

On the proposal of the president, it was resolved to recommend that a Metropolitan District meeting should be held, at which Mr. W. E. Riley had kindly consented to redeliver his Chadwick lecture, entitled "Some Conclusions on Housing Workers," and that it be left to the president and secretary to arrange the date, &c. It was agreed that all members of the institution should be invited to the meeting.

RECRUITING SCHEME: RESERVED OCCUPATIONS.

The secretary reported that, on receiving a copy of List D (Reserved Occupations) issued to local tribunals, he had written to the secretary of the Local Government Board pointing out that no mention of sewage or refuse disposal was made under the head of "Public Utilities," so that it would appear that no provision was being made for retaining men for these services. It was resolved to recommend that the action of the secretary be approved, and that he should be instructed to take such further steps in the matter as appeared desirable. The secretary was at the same time directed to draw attention to the special importance of retaining some of the men engaged in the collection of refuse.

The report of the committee was approved and adopted.

STANDARD FORMS FOR STATISTICS.

Mr. E. J. Elford reported that at a meeting of the Standardisation Committee approval had been given to a preliminary list of subjects for future consideration. The committee also agreed on the order in which certain of the subjects should be considered, and the members undertook to prepare and bring up draft forms for discussion at subsequent meetings.

The report was adopted.

REPORTING OF DISTRICT MEETINGS.

At a meeting of the Finance and Journal Committee this question, raised in a letter from Mr. J. H. Drew, was deferred for the consideration of the council.

The action of the committee was approved, and the following resolution was passed:—

"That, while local circumstances must in all cases actually decide whether or not it is desirable for all meetings to be reported, the council is of opinion that it is generally advisable and desirable that the meetings of the institution should be open to the Press."

ADDITIONAL MEMBERS ON GENERAL PURPOSES COMMITTEE.

Messrs. T. Moulding, P. H. Palmer, N. Scorgie, W. J. Steele, J. A. Webb, and C. F. Wike were, on the recommendation of the Selection Committee, appointed to fill vacancies on the General Purposes Committee.

SOUTH AFRICAN EXAMINATION.

A report was received from the acting examiners in which they recommended that Candidate No. 1 (Pretoria, 1915) be relegated in law, and that Candidate No. 2 (Pretoria, 1915), Mr. C. M. McComb, be granted the testamur.

NOMINATION OF PRESIDENT AND VICE-PRESIDENTS FOR 1916-17.

It was resolved to nominate Mr. J. S. Brodie as president, and Messrs. T. W. A. Hayward, P. H. Palmer, and H. E. Stilgoe as vice-presidents for the year 1916-17.

Sir James Lemon was nominated as honorary treasurer.

ANNUAL MEETING.

The arrangements for this meeting were left in the hands of the president-elect, Mr. J. S. Brodie.

ENLISTMENT OF MEMBER OF COUNCIL.

At the conclusion of business, Mr. E. E. Wallington Butt announced that he would not be able to attend the meetings of the council, as he was shortly taking up military service; he asked to be excused from attendance, at the same time expressing his thanks for the kind reception which he had received from the council as a new member.

WATER SUPPLY IN THE RAND.

THE VAAL RIVER SCHEME.

In his report for the year ended March 31st last, Mr. W. Ingham, M.INST.C.E., M.I.MECH.E., chief engineer to the Rand Water Board, outlines the proposals to impound from the Vaal River a quantity of water sufficient to provide for a supply of 20,000,000 gallons per day.

The estimated cost of the scheme is £1,250,000, of which £1,146,707 is for engineering. This scheme was selected by the board from twenty-one large schemes, estimated to cost £25,338,926. The estimated working costs per 1,000 gallons is 4·376d., and the fixed charges 4·589d. per 1,000 gallons, or a total of 8·965d. per 1,000 gallons pumped to the Rand.

Although, as stated, the reservoir is designed to impound sufficient water to give a constant supply of 20,000,000 gallons per day, the financial powers are sufficient only to provide for bringing into service a first supply of 10,000,000 gallons per day.

The site of the barrage is 23½ miles downstream of the Vereeniging Railway Bridge, and there will be thirty-six gates 30 ft. in width and 25 ft. in depth. The reservoir will have a length of 39 miles, a depth of 25 ft. 1 in., and a capacity of 13,633 million gallons. The catchment area is about 17,119 square miles, and the average rainfall over the area is about 25 in. The point of abstraction of water will be about 1½ miles downstream of the Vereeniging Railway Bridge. The pipe line will have a total length of 44 miles, and will be composed of 18, 22, 26, 27, 29, 30 and 33 inch pipes.

The silt will be thrown down by sulphate of alumina in six settling tanks with a total capacity of 5·6 million gallons. The water will then be passed through mechanical filters, and after leaving the filters will be sterilised by chloride of lime.

The water will be pumped from the Vaal River under a head of 80 ft. to the main station at Vereeniging, and then repumped, after sterilisation, to Zwartkopjes under a head of 480 ft. From the Zwartkopjes station the water will be raised under a head of 1,020 ft. to a proposed reservoir at Turffontein. The total pumping head, including friction, will therefore be about 1,580 ft. The water will then gravitate from the Turffontein reservoir to the Central and East Central Rand.

Porous Rough Cast Walls.—Rough cast walls are often porous owing to their uneven surfaces, which hold the water from driving rains. We are interested to hear that ten houses in an exceptionally exposed situation at Ebbw Vale were rough casted with Pudloed cement over two years ago and are still perfectly watertight.

Poole Tramway Track Reconstruction.—A letter has been received from the Board of Trade with respect to the proposal of the Poole Corporation to borrow the sum of £6,000 for the reconstruction of a portion of the track between Bournemouth and Poole at Constitution Hill, stating that the board would raise no objection to the borrowing of the amount required. It was explained at the council meeting that it was proposed to borrow temporarily by loan from the corporation bankers, and afterwards by mortgage of the rates.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Has not *The Engineer* of the 17th inst. raised a very important issue in an article commencing with the following question: "Is it not possible to draw up a contract for any structural works of magnitude which shall be perfectly just and fair on all parties?" The article, which explains some of the difficulties in the preparation of such a contract, ends with a request to the readers of the journal to express their views on the subject. Will it not be exceedingly interesting to see if any definite result follows this appeal?

* * * *

Is it a fact that the Manchester Corporation has recently served notices upon a large number of owners and tenants in that city to abate an alleged nuisance by discontinuing the keeping of horses on their premises? Is this a forerunner of what we may expect some day—viz., that it will be illegal to allow horses on our roads on account of the nuisance they cause? Would it not cause a great revolution in our methods of road construction if horses were no longer allowed upon them, and would it not greatly reduce our road scavenging costs?

* * * *

Does the reason for the migration of the Road Board from Westminster to Kensington, announced this week, spring from purposes of economy now that the income of this useful body has been reduced, or is it that their offices are required by the Government for their ever-increasing "departments" of all kinds?

* * * *

Does it not show that there is no ground for alarm with regard to unskilled labour employment in this country during the war when we read that in the county of Kent the cost of surface-picked flints is 7s. 6d. per cube yard, whereas pit flints can be obtained for less than half that price? Are there not many road surveyors in this country who can remember the time when surface flints were cheaper than pit flints, and is not the collection of surface flints a work which is eminently suitable for unskilled labour?

* * * *

Apropos of the above, has there ever yet been a thoroughly scientific reason given for the fact that surface-picked flints are better for road making purposes than those taken from a pit or quarry? Is it that the former contain less moisture, or do they harden with exposure? If this is the reason, could not artificial means be employed with pit flints to bring them up to the standard of surface-picked flints?

* * * *

Is it not a sign of the times when we hear that Major Moss-Flower, M.INST.C.E., who had been nominated as president of the Institute of Sanitary Engineers for the year 1916, has been obliged to decline acceptance of the appointment, owing to the fact that his regiment may be ordered abroad at any moment, and that upon Mr. W. J. Binnie, M.INST.C.E., being approached on the subject he was also obliged to decline the honour, as he was about to apply for a commission in H.M. Forces? Under these circumstances was it not very good of Mr. Cotterill, the present president, to agree to continue in office for another year so as to tide over the difficulty?

* * * *

Is not the following description in *The Car* of December 15th of a badly made tarred road a motor driver's somewhat exaggerated view?: "It either develops a series of craters in which the rain stands in pools for days, or, in damp and shady corners, develops a slimy kind of black pudding—a mass which is worse than the devil's brew of Hecate when splashed over and upon the dress of a fair lady or the uniform of a gay lieutenant." Is not this sentence rather "jumpy" in its composition, and shall we not allow that it has a ring of poetic licence about it?

* * * *

Should not the city of Cork be looked upon as the paradise of motorists when we hear that the council have decided not to proceed any further next year with the collection of the motor licence tax? Should there not be a great rush of motorists to secure this free licence in Cork, and then remove their cars elsewhere? What is going to happen if every other council in the United Kingdom follow the brilliant example of Cork?

Kimberley City Sanitary System.*

By JAMES DUNN, City Sanitary Inspector.

I propose giving some particulars of changes effected during the past two years with our sanitary services, and our reasons for so doing, also to offer some suggestions for future working. The changes have been of a very radical nature, but were forced upon us owing to a series of circumstances which, chiefly for financial reasons, brooked of no delay.

For thirteen and a half years I have been intimately connected with the removal of night soil, slop water, refuse, and street sweepings from this town, when many phases have presented themselves, but for a few years the pails removal service was separately managed, and for seven months in 1913—viz., from March to September inclusive the whole of the removal services were under a separate management. This was thought better probably owing to amalgamation with our sister township Beaconsfield, and also to the introduction of motor haulage. However, in October, 1913, all the services enumerated reverted again to the sanitary department, and it is from this date onwards that I am about to give an outline of events.

REFUSE REMOVAL.

In October, 1913, a 4-ton motor lorry for removal of refuse had been working in Beaconsfield for four months, but, as had already been discovered in other parts of the world, it was not proving a financial success. In Kimberley this would be particularly difficult, seeing that with us animal haulage can be effected cheaper than in England, while the expenses in connection with motor haulage would have to be multiplied by about three. For motor haulage quick loading is essential, and to bring this about a novel method was resorted to in the collection of refuse in sacks, and their quick delivery on to the motor. The work of the motor was thus doubled, but it was still found that the motor only displaced three instead of six wagons, and that the new system of loading applied even better to a stream of wagons being continually filled than to one large motor vehicle, which allowed the filled-up sacks to accumulate during its absence at the tip.

The refuse motor vehicle having failed in its mission, its use was discontinued, but the bag system of collecting house refuse remains, and has been extended to the whole town, and is of assistance also in a portion of our street cleaning operations. The work is now arranged as follows: An overseer is in charge of the bag gang, which consists of about twenty-four natives, each having an ordinary store or sack truck with a 15-in. spiked ring at the top for holding the bags in position, and open so as to facilitate filling. The trucks are now provided with 14-in. diameter wheels in lieu of those originally of 7 in. in diameter; thus they are shifted about much more easily. The trucks with bags are taken from house to house, filled, and then deposited at a convenient spot to be picked up by a wagon. Four wagons are employed, working in pairs, with three loading boys for each pair. Boys and wagons are thus kept constantly employed in loading up and conveying the filled bags to our refuse depot for trucking by rail.

This bag system has adapted itself well to Kimberley, and there has not been a single complaint against it. The supervision is wellnigh perfect, far more so than that of a number of wagons scattered about the town and working independently. The wagons remove six or seven loads daily, against only three formerly, and we have to-day six wagons working in lieu of thirteen and one 4-ton lorry two years ago. As a portion of the street sweepings are picked up by labourers attached to the bag gang, and the total number of animals having been reduced from thirty-six to fourteen, partly owing to this, for comparative purposes I will now give the combined cost of three recent months' working against the three last months of the old system. For the quarter ending September 30, 1913, the cost of street cleaning and refuse removals amounted to £1,887 6s. 7d. For three months ending June 30th last the cost was £1,156 14s. 7d., representing a saving at the present moment of £730 12s. per quarter, or £2,922 8s. per annum, which is an amount more than sufficient to pay for the whole of the street cleaning in former years. On refuse removals only, the cost of the service for Kimberley and Beaconsfield is to-day about £800 per annum less than for Kimberley alone before amalgamation. Owing to war conditions, labour for this work is cheaper than usual, and somewhat less refuse may be removed, but the same area of ground has to be covered, and the reductions here shown could not have been made on the old system of wagons working independently in different parts of the town, going from house to house at their leisure.

As labour and locomotion form the two chief items of expenditure in both the refuse and street cleaning services, and as it might be thought that the present bag gang tends to increase the wages bill, some figures to disprove this appear to be necessary. The expenditure in this direction for the third quarter of 1913 (wagon system of collection) and the second quarter of the present year (bag gang) are represented as follows:—

	Old system.	New system (bags).	Saving.
Wages—			
Refuse ...	£588 3 0	£344 13 0	£243 11 0
Streets ...	418 1 1	308 10 11	109 10 2
	£1,006 4 1	£653 3 11	£353 1 2
Produce—			
Refuse	£164 3 10	£84 15 3	£78 8 7
Produce—			
Streets ..	73 12 3	16 14 8	56 17 7
Motor—			
Refuse ...	120 9 9	—	120 9 9
	£358 5 10	£101 9 11	
Saving on produce, &c.			£256 15 11
Saving on wages			353 1 2
Gross saving on locomotion and labour per quarter			£609 17 1

To continue the present system large supplies of bags will be required, and I would suggest the advisability of communicating with firms in India, where the raw material is prepared and made up, with a view to bags being manufactured for the sanitary department.

PAIL REMOVAL SERVICE.

The urgent need of changes in the pails service became strikingly apparent about sixteen months ago, owing to the alarming increase in cost of feeding our herds of oxen and donkeys after successive seasons of drought, and the position was intensified after the outbreak of the war, when our spare animals were returned from the resting farms. Our produce bill of £600 per annum showed signs of being doubled, and even trebled. A remedy, if possible, had to be found.

In June last year I suggested as a solution the deposit of the liquids from the night-soil wagons into our slop sewer, and conveying the solids only by wagons to its depositing site. Thirty-six mules were required to substitute our 200 head of oxen and donkeys, and being quicker, one tank wagon, it was hoped, would do the work formerly performed by two, and with less labour. I submitted a strainer of my own design, which had been found successfully to run off the liquids from our tank wagons, and at the same time hold back the solids.

To effect the changes without hitch, and in the face of certain opposition, has been a somewhat formidable undertaking, and it is only now that we are in a position to show that the certain increased expenditure which was apparent in this service has been staved off. Every branch of the service has had to be altered. The means of straining had to be proved satisfactory beyond doubt, and had to be altered nine or ten times after slow and somewhat disappointing experiments by night before being deemed safe and reliable. Donkey and ox wagons had to be altered in a day for mule transport. Separate wagons for conveying buckets only were made up from discarded refuse vehicles. Thirty-six mules or horses had to be found; eighteen dispensed with from the refuse and street cleaning services were utilised, and eighteen mares were purchased. Harness was made. Stables were built, bricks being made on the spot, and roofing material obtained from the disused public wash-houses, and for all this relief labour was available. Also the grazing camp on the Vooruitzight estate was brought from

* Report to Kimberley Town Council.

3 miles to 1 miles nearer our depositing site. At the outbreak of the war the native labourers resented not having been informed by us that war was coming, and wished to depart to their homes without delay. Parleying being of no avail, they were told they could go, when, fortunately, some decided to remain on, but we were nevertheless considerably hampered. Alterations going on at this time, and with the military forces in our midst, were a severe tax on all concerned, as all the beats in town had to be rearranged to fit in with the new order of things; in fact, the whole organisation was affected.

Probably no saving would have been possible had we not been able to dispose of the liquids in our slop sewer instead of hauling it more than 3 miles out of town, and then dispose of it in an expensive manner. In addition to the use of the slop sewer, special underground tanks have been constructed at convenient spots, and the Beaconsfield night-soil motor vehicle having been put off and fitted with a vacuum tank, the liquid is drawn off by the vacuum process, conveyed by motor to the slop sewer, and two motor trips to the depositing site are thus saved.

The change from ox-drawn oxen and donkeys after "only years' use" to mules is now much appreciated by all sharing in the work, and one gratifying feature was the making of £300 by the council in the transactions. So far the actual cost of feeding has been in excess of the normal cost for the oxen and donkeys, but that other reductions have been satisfactorily effected is shown in the total expenditure. For Kimberley alone the cost of the pail service for 1911 was £8,681 12s. 1d., while for Kimberley and Beaconsfield for 1915, £9,000 will probably be about the total expenditure, or about £300 extra only for Beaconsfield, a service that must before amalgamation have cost something in the neighbourhood of £1,600 per annum.

With the deposit of the liquids in our slop sewer and the quicker working with the mules, a saving of labour has been effected both at the depositing site and in the night removals, as the weekly wages for last week and the corresponding week of 1913 at the compound and site will show:—

	Wages week ending Sept. 23, 1913.	Wages week ending Sept. 21, 1915.	Present saving per week.
Compound ...	£71 19 0	£67 15 10	£7 3 2
Site	2 / 18 6	23 3 6	6 15 0
	£104 17 6	£90 19 4	£13 18 2

In 1912 the compound wages amounted to over £78 per week.

Reduced labour to the extent of over £700 per annum is here shown, and further economies are believed to be in sight. Reduced wages owing to the war have had practically no effect on this service, as it was not considered safe to run any risk with such an important undertaking.

With the discontinuance of oxen from this work, and owing to the almost entire removal of liquid from the tank wagons, I suggested a mono-rail truck system for receiving the solid contents of the wagons at the depositing site. The principle was approved, but owing to the outbreak of the war it was not considered wise to order the material from home then. However, mining trucks and rails were obtained from De Beers Company, and the system has proved entirely successful, one small mule now doing work formerly undertaken by eight oxen.

SLOP WATER REMOVAL.

The removal of slop water differs from the two former services in that it is not compulsory. Not a tenth of the inhabitants participate in it. This increases the cost of the service, and practically constitutes an extra tax upon those who see fit to give us their slop water, or a portion of it. In the interests of these people alone it is necessary that all economies should be observed in order that the charges can be reduced to the lowest margin.

During past years various efforts have been made in order to secure the removal of the largest amount of dirty water possible from the town, but it is difficult to attract fresh custom.

The slop water removal has really been a most intricate business, and the supervision most difficult, owing to the scattered houses of call, the continuous checking required, and the abuses sometimes discovered. However, this year a strenuous effort has been made to induce economies, and to give a satisfactory service. At the end of last year six wagons were working. In January one wagon was put off, and the work easily performed by the remaining five; in fact, from various checks applied there did not appear to be sufficient work for this number, and this has been proved during the present month, for with certain changes in working we have been successful in continuing the work with another wagon less.

Motor haulage is applied to certain premises having large quantities of slop water. I have recommended that the charges should be levelled up in some cases commensurate with the amount of water being removed, and that all motor accounts of both revenue and expenditure should be separately kept. Our motor tariff has been equitably drawn up, and should be strictly applied. As the motor and animal services are in reality two separate concerns, the profit or loss in each case should be known. As an instance of this, for some weeks we have had two permanent motor drivers off sick; clearly the loss sustained should be against the motors only, and not in any way against the wagon service, as would be the case at present.

At the slop water irrigation site various improvements have been effected. Taking advantage of available relief labour about 2 miles of brick furrows have been laid—in lieu of the ever-offensive earth sluits—the bricks being obtainable from an abandoned neighbouring brickfield. Further, some hundreds of young red gum trees have been planted, with promise of good results. Ground has been specially prepared for the reception of the liquid from the night-soil wagons, where it is dealt with at a trifling cost. And on the east side of the main line land running parallel with the slop fence has been fenced in for departmental grazing purposes. Recent crops of lucerne and barley have been satisfactory, bearing in mind the entire absence of clean water and the complex nature of the foul water with which we have to deal.

MOTOR SERVICE.

A few remarks on the work of the motor vehicles generally appears to be necessary. The three Lacre motor vehicles were got to work at the end of June, 1913. I had nothing to do with the preliminaries. One 5-ton vehicle was detailed off for slop removals, Kimberley—bucket work—a second was for pails removals, Beaconsfield, and the 4-ton was for Beaconsfield refuse removals. At no branch, however, could the motors be said to justify their existence, and no provision was allowed for against breakdowns.

In order to bring about quick loading, which is essential with heavy motor work, but impossible with house-to-house calling for small quantities, our motor vehicles have recently been detailed off for larger slop removals only, chiefly by the vacuum process. They are fitted with vacuum tanks, and the remaining chasses acts as a stand-by. In this way they can each do the work of from four to five horse wagons, and probably at just about the same cost.

In considering the question of our means of motor transport for the future, I think it will be found that tractors with trailers would meet our purpose far better than the motor lorries now in use. The tractors would be available at any time for any of our sanitary services, it remaining for the trailers to be specially fitted for the particular loads they would be intended to carry. These trailers would be filled and await the tractor, and thus much of the time now lost during loading would be saved.

With the tractor-trailer system the feasibility of hauling our refuse direct to its depositing site suggests itself, thus saving certain animal haulage and double handling—that is, in loading-up and off-loading our present railway trucks.

Trailers in the form of wagons would collect the bags of refuse—before referred to—and when full be left at a convenient spot near by to await the tractor, which would haul it, with others, direct to the depositing site. I suggest that early consideration should be given to this matter, seeing that the life of our motor lorries is limited.

DEPOSITING SITES.

We have three depositing sites, that for night-soil being 5½ miles west of the town, the slop site 2 miles to the north, and our refuse siding 2 miles beyond that. One can easily see how these things came about, and there appears to be nothing to be gained in traversing this matter; but I do think the time has arrived to consider the possibility of one site only being established.

All our slop water, the liquid drawn off from the night-soil tanks, and dead animals are deposited in the vicinity of the slop site, and at one time also

The Surveyor
And Municipal and County Engineer

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[illegible] one combined site for all purposes. Water would [illegible] purposes with limestone, which abounds in the vicinity.

There would be many advantages to be derived [illegible] would be simplified, and the question of transport greatly facilitated, and a visit to our sanitary trenches would satisfy anyone. I think that the work now being done there could be very well carried out elsewhere, both the washing of buckets and the disposal of the night-soil, but these could be improved. [illegible] required daily now that the liquid is drawn off.

The present Dronfield refuse siding costs about £1,000 a year, being £600 for railway haulage and £400 for labour. With petrol or paraffin tractors, refuse could be hauled from any part of the town, as already mentioned, direct to the tip, the start of which would be the reclaiming of the ground washed [illegible] ultimately formed would be no less favourable than [illegible]

[illegible] that the oxen and donkeys have been disposed of, and also with the development of motor haulage on proper lines, but we shall be hampered until a uni[illegible] sewerage or a refuse destructor have not been overlooked, but until such are decided upon we are quite justified in endeavouring to advance in any direc[illegible] a scheme would take a considerable time to mature, but I am of opinion that, with available water, it [illegible]

Home-grown Timber Committee.—The President of the Board of Agriculture and Fisheries has appointed a committee for the purpose of making such arrangements as are likely to ensure the fullest use being made of native resources in supplying existing demands for timber. The committee are prepared to purchase standing timber, and to make arrangements, where necessary, for felling, hauling, and conversion. They will be glad to receive particulars of timber which landowners and others would be willing to sell for Government purposes. All communications for the committee should be addressed to the Secretary, Home-grown Timber Committee, Craven House, Northumberland-avenue, W.C.

WEST RIDING SEWAGE DISPOSAL PROBLEMS.

DESTRUCTIVE TRADE EFFLUENTS.

From the minutes of the Domestic Sewage Committee, presented at a meeting of the West Riding Rivers Board on Friday last, it appeared that the Local Government Board had withdrawn the sanction given to the Golcar Urban District Council to borrow money for improvement of the Crimble sewage works. The council had, however, given a written undertaking to proceed with the work as soon as sanction could be obtained from the Local Government Board. The Huddersfield Corporation, said the chairman of the committee, Alderman T. B. P. Ford, had complained of acid sewage affecting the dis[illegible] at Cooper Bridge sewage works, and a recommendation of the chief inspector (Dr. Wilson) had been approved permitting the direct discharge of the tank effluent into the stream when the sewage is of an acid character, until proper measures have been adopted by British Dyes, Limited. This dangerous acid, the chairman said, was waste acid discharged from picric acid works. The sewage from those places had become so highly acid as to threaten the destruction of the plant of the Huddersfield Corporation. It would be quite unfair that the corporation should have its valuable plant destroyed, which could not be replaced at this time. The British Dyes, Limited, were putting down plant which would reduce the acidity, but this could not be in operation for two months or more.

The Halifax Corporation had not sufficient plant to deal effectively with the sludge at their Salterhebble works. They could not make their enlargements under the present conditions, but they were being urged to make all arrangements so that they could proceed with the improvements as soon as the war is over. The Bradford Corporation, continued the chairman, were experiencing the same difficulty at the North Bierley sewage works as the Huddersfield Corporation at Cooper Bridge. Temporary measures, however, had been taken to neutralise the acid in the effluents, pending final arrangements. It was hoped that permanent arrangements would be adopted. The Tadcaster Rural District Council were unable to carry out the extension of the Kippax sewage works at present, but they were being urged to complete their plans.

Mr. J. G. Newsham proposed the adoption of the minutes of the Manufacturing Pollutions Committee, in which reference was made at length to the damage which was being caused to machinery and plant of sewage works by the discharge into streams of picric acid from explosive factories. The attention of the Ministry of Munitions, the War Secretary, and the Local Government Board had been called to the matter, and from the Ministry of Munitions a letter had been received stating that experiments were being made at the Low Moor chemical works with a view to recovering the waste acids; if these experiments were satisfactory the process would be communicated to firms concerned. An inspector had been down making inquiries. Most works were now taking steps to prevent waste acid reaching the stream.

Diaries and Calendars.—The London and Lancashire Fire Insurance Company, Limited, of 45 Dale-street, Liverpool, issue, as usual, an exceedingly dainty diary for a month's memoranda, and a desk tablet of tear-off sheets with, under each day's date, a space for notes.

Institution of Water Engineers.—Our report of the discussion on the paper, "The Definition of the Term 'Domestic Purposes' in General and Private Water Acts," which was read by Messrs. A. B. E. Blackburn and Percy Griffith at the recent meeting of this body, and reproduced in our last issue, is unavoidably held over until next week.

New Lighting Regulations.—Two new Orders dealing with street lighting and lights in shops, houses, &c., have been issued. One, the Lights (East Coast) Order, amends the Order issued in April last for the eastern and south-eastern counties, and the other re-enacts the much less stringent requirements in force on the West Coast. These amendments, which embody the results of the experience gained during the past half-year by the naval and military authorities and by the police, are for the most part of a minor character.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The following books have been chosen in respect of the premium for November:—

By Private B. Knight, of Newport, "Roofs and Bridges," Part I., by Merriman and Jacoby (Chapman & Hall), and

By Mr. J. G. Wilkin, of Downpatrick, "Drainage and Sanitation," by E. H. Blake (Batsford).

Both books have been duly sent and acknowledged by the recipients.

QUESTIONS.

This week answers are invited to the following questions:—

517. Venturi Meter.—Describe, with sketch, the construction of the Venturi meter, and explain the hydraulic principles on which it is based. ("Hydraulics.")

519. Mechanics.—Define the terms "force" and "work done by a force." What are the units of force and work as adopted by engineers in this country? State the relations between the gravitation and absolute units of force and work, and say why the latter units are so desirable for many scientific purposes. ("Student.")

520. Properties of Materials.—Compare the properties of wood and steel as regards the use of these materials for beams. (T. R.)

521. Mechanics. What fraction of the weight of a body is required to keep it from flying off the earth's surface, at the equator, supposing the equatorial radius of the earth to be 4,000 miles, and that it makes one complete revolution on its axis in a solar day of twenty-four hours? (H. P. H. M.)

522. Laundry Design.—A laundry is required for a temporary boys' hostel accommodating 400 boys. The laundry to be constructed of 4-in. by 2-in., &c., timber, weather-boarded outside and lined with asbestos sheets inside. Provision to be made for drying-room, iron-room, wash-house, engine-room, coals, &c. The laundry to contain washing machine, wringing machine, mangling machine, &c., and an engine to drive machines, with boiler-house. Give plan, elevations and sections of a suitable laundry, with sizes of machines. ("Ajax.")

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

518. Strength of Materials.—Explain clearly the meaning of the terms (*a*) stress, (*b*) strain, (*c*) modulus of elasticity. What is the relation between them?

All members of a loaded structure—except those inserted for ornament—are exposed to stresses and strains. These two terms are sometimes used indiscriminately as meaning the same thing; strictly, they represent cause and effect. "Stress is the mutual action between two bodies or portions of matter, taking into account the whole action between them." It is variously described as attraction, repulsion, tension, pressure and shearing, according to the mode of action. A strain is a change of form. When an external force acts upon a bar of any material, it produces in the bar a change of form, no matter how minute. It may elongate it, or shorten it, or bend it. This change of form is termed a strain. Strains may be temporary or permanent. If, after the force be removed the bar regains its original shape and dimensions, the strain on its fibres will only be temporary, and will only last during the application of the force. If, on the other hand, the bar does not regain its original shape and dimensions after the removal of the force, it is said to be permanently strained. By a stress is meant the internal force or resistance set up in the fibres of the bar in opposing the strain. The stresses in materials are proportional to the strains, so long as there is no permanent alteration in the form of the body acted upon. There are three kinds of stresses and strains: (1) Compressive or positive stresses and strains; (2) tensile or negative stresses and strains; (3) shearing stresses and strains. If a bar of any material be acted upon by two equal forces applied at its extremities and acting away from each other in the direction of its length, the bar becomes extended and the strains produced in the fibres are said to be tensile or negative strains. The stresses or resistance to the straining action on the fibres are in like manner termed tensile or negative stresses. If, however, the bar be acted upon by two equal forces acting toward each other, the bar becomes shortened and the strains and stresses generated are termed compressive or positive strains and stresses. A tensile stress on a bar tends to cause its failure by lengthening and ultimately tearing apart its fibres; a compressive stress induces failure by shortening and ultimately crushing its fibres; and a shearing stress produces failure by causing one part to slide across the other, or by cutting it across.

Besides these three kinds of stresses there are others which are frequently met with, the most common of which are transverse or bending stresses, and torsional or twisting stresses, with their corresponding strains; but these and other forms may be resolved into one or more of the three elementary forms.

Measurement of Stresses and Strains—

Where English standards are adopted a stress is measured by so many lbs., cwts., or tons. A unit stress is usually measured by so many lbs., cwts., or tons per square inch of sectional area of the body under stress. If the stress on a bar of iron 2½ in. square be 50 tons, the unit stress or stress per square inch will be 8 tons.

A strain is usually measured in inches or parts of an inch. A unit strain is measured in parts of an inch per lineal foot of the bar under strain, or it may be measured as so much per cent of the length of the bar. If a bar of iron 1½ ft. long under a certain tensile stress be lengthened by ¾ in., the strain produced is equal to ¼ in. per foot, or 2·08 per cent of the length of the bar.

Tensile stress, shown in Fig. 1. A bar $a\,b$ of section A square inch is suspended at one end extremity a; and a weight of W tons is hung from the other end b. The bar under these conditions is said to be subjected to a tensile stress of W tons throughout its entire length, or to a unit stress of $\frac{W}{A}$ tons.

Compressive stress, shown in Fig. 2. A pillar rests on the ground, and a weight of W tons rests on the top. The pillar is under a compressive stress of W tons, and if A equals its sectional area in square inches, the fibres are subjected to a compressive stress of $\frac{W}{A}$ tons per square inch throughout its entire length.

Shearing stress, shown in Figs. 3 and 4. Two links of iron are joined together by a pin of the same material, and are exposed to forces of W tons acting in the directions indicated by the arrows. In both cases the pin is subjected to a shearing stress. In Fig. 3 the pin is exposed to a single shearing stress of W tons at its section $a\,b$, and is said to be in single shear, and if A equals number of square inches in its sectional area, the shearing stress per square inch on the pin equals $\frac{W}{A}$ tons.

In Fig. 4 the pin is exposed to a double shearing stress at its sections $a\,b$ and $c\,d$, and is said to be

in double shear. The shearing stress at each section is equal to $\frac{W}{2}$ tons, and if A_1 equals sectional area of the pin, the shearing stress per square inch equals, expressed as before, $\frac{W}{2A_1}$. From this it is apparent that the sectional area of the pin in this case need only be half that in the previous case (Fig. 3) in order to give it equal strength.

Transverse or bending stress, shown in Fig. 5. Here the beam A B rests on two supports at A and B, and is loaded at an intermediate point by a weight W tons; the beam in this condition is said to be exposed to a bending or transverse stress, but the fibres in the upper portion of the beam are subjected to a compressive stress, and those in the lower portion to a tensile stress, and shearing stresses come into operation also throughout the beam. Torsional or twisting stresses do not often occur in the members of structural work, but they are met with in shafting and machinery of all descriptions. It is usual to assume that the stress on a bar is uniformly distributed over the whole cross-section of the bar. This is generally true as regards tensile and compressive stresses, so long as the bar is

Fig. 1

Fig. 2

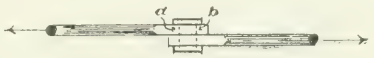


Fig. 3

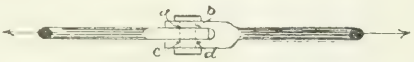


Fig. 4

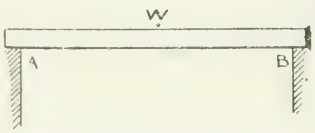


Fig. 5

of a compact form. It is only approximately true when applied to shearing stresses, and the form of the pin or bar exposed to this stress has something to do with this failure of uniformity. It has been found from experiments that the maximum intensity of shearing stress on a round pin is somewhat greater than the mean intensity, and with a pin of a square or rectangular section the difference is greater still. For all practical purposes, however, it may be assumed that the stress is uniformly distributed over the section. Beside these tensile, compressive and shearing strengths there are other properties of materials which make them valuable for structural purposes, and elasticity is one of these. A most important distinction in solid bodies, from a mechanical point of view, is that some are elastic and others imperfectly elastic. Elastic bodies recover their form after the straining action is removed, or the stress and strain arise and vanish simultaneously. Imperfectly elastic bodies are permanently altered in shape or volume by a straining action. Brittle bodies are those which break in pieces under a straining action before there is any great alteration of shape. Other materials can be greatly deformed without losing continuity or breaking into fragments, and are termed malleable, ductile, or plastic, according to the mode of application of the stress. The word which expresses best the property of suffering an indefinitely large permanent deformation is plastic. A brittle material will break with an increasing stress before the permanent deformation is large. A ductile or tough material under an increasing stress will become plastic and undergo a large permanent change of shape. Therefore deformations due to straining action are either elastic deformations or plastic deformations, often termed permanent sets. Bauschinger, by experiments, has shown that most materials used in construction except a few like hard steel—show a small amount of permanent set after loading the first time, even when the loading is comparatively small. But in many materials, and up to a certain limit of stress, termed the elastic limit, the permanent sets are very small, and may possibly be rather ascribed to initial want of straightness in the bars tested, or to small defects of homogeneousness than to any inherent property of the material. If a gradually increasing tensile stress be applied to a bar of any material it will become elongated or stretched, and the amount of this elongation or increment of length, within certain limits, will be proportional to the stress applied. The same law will apply if the bar be subjected to a compressive stress. In this latter case the bar will be shortened, and the amount of the shortening or decrement of length will be proportional to the stress within the limits named.

Modulus, or "measure," which is the meaning of the word, of elasticity may be defined as the ratio of the increase of stress to the resulting increase of strain, within the elastic limits; consequently, knowing the values of the stress and the strain, the elastic modulus of the material may be obtained by simple division, and its value will be nearly constant for the same sort of material. This principle is known as Hooke's law of uniform elastic reaction, or the law of elasticity. The modulus for tension and compression is generally known as Young's modulus, and the symbol used is E; that for shear is termed the shear or rigidity modulus, the symbol G being used. There remains an additional modulus, termed the bulk or volume modulus, and the symbol for this is K. This modulus represents the ratio between the intensity of pressure or tension and the initial change in volume on a cube of material subjected to pressure or tension on all faces. Young's modulus is the one most concerned with the design of structures; elasticity, a measure of strength. The elasticity of a material used in a structure is a very important measure of its quality, even more so than its ultimate compressive or tensile strength.

Modulus of elasticity—

Let L = length of a bar in inches.

P = stress applied to it in tons per square inch.

b = increment or decrement of length in inches arising from the stress P.

From Hooke's law, when P varies b will vary in the same proportion, so that the expression $\frac{P \times L}{b}$

... and quantity for all values of P within the elastic limits of the material. This expression is termed the modulus of elasticity of the material and E. Consequently we have E $= \frac{P \times l}{a}$. In this equation, if we put l = b, we get E = P. So that the modulus of elasticity may also be defined as that tensile force in tons per square inch, which, if applied to a bar, will double its length, on the assumption that the material is perfectly elastic up to this point; but it is unnecessary to say that no structural materials fulfil this condition. The limits of stress between which bodies are elastic are termed their limits of elasticity, and this varies considerably for different materials. Lead, for example, has little or no elasticity; if it be strained to any appreciable extent, when the stress producing the strain is removed, the strain itself does not suffer any appreciable diminution; lead may therefore be termed a non-elastic substance.

Glass, on the other hand, is very elastic; if it be strained just up to its breaking point, upon removing the stress it will regain its original dimensions. Iron and steel occupy a position intermediate between lead and glass in regard to their elasticity; they are elastic, or nearly so, up to about one-half of their ultimate strength.

When a body under stress passes its elastic limit the increments or decrements of length increase at a much more rapid rate, until finally rupture takes place. (E. W. P., *Southampton.*)

CORRESPONDENCE.

Ἐς ἅπαν οὐ τετεύχ' ὁρᾷ
(One man does not see everything.)
—EURIPIDES

MUNICIPAL POLITENESS.

To the Editor of THE SURVEYOR.

SIR,—One occasionally reads of rather weird instances of the manners and customs of local authorities which savour of those of certain mid-ocean islanders, and which were described by a visitor as "Manners none, customs nasty." Perhaps they might pass muster in the case of a town like Bunkumville, where the offices of surveyor, inspector, grave-digger, town crier and district visitor are combined, but in the case of an important and presumably dignified borough one might at least expect better manners.

What do you think of the following? In April last the borough of Newark-on-Trent invited applications for the appointment of borough surveyor, and applicants were informed that they would be permitted, if they chose, to send printed or typed copies of testimonials to the members of the town council, twenty-four in number. I for one did so choose, at, of course, some trouble and expense, and have no doubt others did the same, and in due course my application went in. Time passed, and not a word of any description reached me until, seven months later, I wrote out of pure curiosity to one of the prominent borough officials and gently reminded him of my state of ignorance. To my great astonishment, which was mixed with amused indignation, I received a reply informing me that "an appointment was made in May last . . . as there were 139 applicants it was not convenient to give this information to all."

Really, Sir, might not one be excused for thinking that, if it was convenient for the Newark Town Council to put gentlemen to the trouble of getting recent testimonials and sending in applications, it might at least have been convenient for them to afford the courtesy of a letter to each applicant announcing the result, or saying "Thank you"?

Don't you think, Sir, that this case would almost win the proverbial biscuit for municipal politeness? But there, perhaps it's all "on account of the war," which seems to be the peg on which every mortal omission or misdeed is hung nowadays.—Yours, &c.,

APPLICANT.

December 20, 1915.

BREAKING UP OF TARRED SURFACES.

To the Editor of THE SURVEYOR.

SIR,—Very much of the tarred surfaces of several of my roads has suffered severe damage from the weather during the past fortnight. The tar and slag screenings coats have broken up all over the roads, much as one might expect ice to break up, by traffic, if one could imagine a road coated with ice ½ in. thick. Only refined tar and slag screenings are used, and until the wet weather and frosts came there were perfect surfaces, whereas now large areas of all the tarred roads have broken up in brittle cakes of various sizes and thicknesses.

Work done last season has not suffered in my district, but in an adjoining district where similar tar was used it has broken up as badly as my 1914 and previous work has done. The road metalling is slag, water-bound, and the same effects obtain whether the subsoil is clay or sand. The working temperature of the tar when applied was that mentioned in the Road Board specification.

Tar, where sprayed on tar-macadam surfaces, has not suffered in this manner.

Such widespread injury has not been experienced here for about nine years.

I am hopeful that the insertion of this letter in your valuable journal may produce the experience of other surveyors, and a remedy.—Yours, &c.,

R.D.C. SURVEYOR.

SELF-PURIFICATION OF RIVERS.

To the Editor of THE SURVEYOR.

SIR,—At a meeting of the Association of Sewage Works Managers, held in London a short time ago, Dr. S. Barwise is reported to have said (*vide* THE SURVEYOR, December 17th last, p. 630): "One thing he could never understand was how the Royal Commission came to the conclusion that there was no river in England long enough to effect its own purification. That had stopped experiments in this country for twenty years."

This paragraph, as it stands, is erroneous and liable to mislead. The '98 Sewage Commission never made the above statement. Presumably, Dr. Barwise meant the '68 Rivers Pollution Commission, who used words to that effect. That, however, was nearer fifty years ago than twenty years.—Yours, &c.,

G. BERTRAM KERSHAW, M.INST.C.E.

9 Victoria-street, S.W.
December 17, 1915.

SOCIETY OF ENGINEERS.

ANNUAL GENERAL MEETING.

The sixth annual general meeting of the Society of Engineers was held at the offices of the Society, 17 Victoria-street, Westminster, on Monday, December 13th.

The awards of premiums made in respect of papers published in the Journal of the Society during 1915 were announced as follows:—

The President's Gold Medal to Mr. Arthur H. Barker, B.SC., for his paper entitled "Some Future Developments in Heating and Ventilation."

The Bessemer Premium, value £5 5s., to Mr. Alphonse Steiger, M.INST.C.E., for his paper on "The Modern Development of Water Power."

A Society's Premium, value £3 3s., to Mr. Sydney G. Turner, Barrister-at-Law, ASSOC.M.INST.C.E., for his paper, entitled "Law and Engineering: Some Points of Contact."

A Society's Premium, value £2 2s., to Mr. Frank Grove for his paper on "Main Roads, Past and Present."

The report of the council was read and adopted. The scrutineers of the postal ballot reported that the following had been elected as members of the council and officers for 1916: President, Mr. Percy Griffith; vice-presidents, Messrs. Henry C. Adams, W. B. Esson and W. Noble Twelvetrees; members of council, Messrs. Henry Adams, C. T. Walrond, F. L. Ball, Burnard Green, the Rt. Hon. Lord Headley, F. H. Hummel, T. J. Gueritte, B. H. M. Hewett, G. A. Becks and G. O. Case; associate member of council, Mr. C. E. May; hon. secretary and hon. treasurer, Mr. D. B. Butler.

Votes of thanks to the council and officers for 1915, and to the scrutineers of the ballot lists for the election of the new council were passed unanimously.

Concrete Pipe Manufacture.—An engineer to a South African municipality asks for the names of manufacturers of concrete pipe machines. He desires to be supplied with prices and other particulars of machines to turn out pipes of from 4-in. to 18-in. diameter inclusive. Replies, addressed to the Editor, will be forwarded.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Students and others in order to make the information given under this head as complete as possible.

BUILDINGS.

Barnet U.D.C. The council met for the first time recently in the new offices, and in the course of the proceedings the chairman, Councillor A. J. Wills, J.P., remarked that whatever room they went into they could not fail to notice the solid goodness and English character of the premises. If there was a room with which fault might be found it was that of the surveyor, Mr. W. B. Chancellor, which was certainly the least pretentious room in the building. It said much for the modesty of the surveyor that he should have provided so small a room for himself when he might have had a larger and more pretentious one. He (the chairman) thought the surveyor had shown excellent taste in the lighting arrangements. The chairman added that great credit was due to Mr. Chancellor for keeping the cost of the building within the estimate.

Chadderton U.D.C. — The chairman, Councillor Carter, stated that the clerk had received from the architects, Messrs. Taylor & Simister, a statement of the cost of the new town hall. The total contracts made amounted to £14,633 15s., architects' commission £1 14s. being for the £1,700 under it, a total of £17,474. Sanction was obtained for loans for building, &c., £15,839, site, £1,700, total £17,539. One of the things very rare in public life was that the bill came out below the estimate. He thought Messrs. Taylor & Simister were to be complimented on the success of their work, and he thought it was very satisfactory to the committee when they found the building had been erected for less money than they let contracts for.

Dalkeith T.C.—The surveyor, Mr. J. L. McDougal, has received instructions to prepare plans for a small-pox pavilion at Cowdenbog.

Lewisham B.C.—The Works and Highways Committee recommend the purchase from the London County Council for the sum of £200 of a site at the junction of David's-road and Devonshire-road, Forest Hill, for the construction of a public convenience.

Loughborough T.C.—The town council recently had under discussion the question of plans for a temporary building for Mr. H. Clemerson, a member of the council, in Commercial-place. These plans showed that it was proposed to build over a recess in the Dark Hole-yard, which was claimed as part of the highway. Though not admitting such a claim, Mr. Clemerson offered, as a set-off, if the plan were allowed, to give up a piece of ground which was required by Messrs. Offiler & Co., Limited, to enable them to carry out their proposal to widen the corner of Swan-street when rebuilding the Green Man Inn. The Highway Committee had resolved to allow the plan, subject to such amendments as were required to comply with the building by-laws, but the council overruled this and rejected the plans.

Richmond (Yorks) T.C.—The town council have accepted a site in the Friars' grounds from the Marquis of Zetland for the purpose of a public lavatory, and it is proposed to construct a building at an estimated cost of £125.

Wombwell U.D.C.—The surveyor, Mr. W. Quest, has been asked to report upon a suitable site for a public mortuary.

HOUSING AND TOWNPLANNING.

Carlisle T.C.—Although a loan for the housing scheme has been refused at present the town council have authorised the Health Committee to make the modifications required by the Local Government Board, and to proceed with other necessary details.

Dartford U.D.C. A scheme has been approved by the Local Government Board for the erection of 102 cottages by the council.

Grimsby R.D.C.—An intimation has been received that the Local Government Board would sanction the proposed town planning scheme for Immingham provided the rural council would co-operate with the Grimsby Town Council in the construction of road accommodation between the docks and Grimsby.

Huddersfield T.C.—A site consisting of upwards of 11 acres has been acquired for a housing scheme.

Sidmouth U.D.C.—It has been decided that the rents of forty-two houses shall, in connection with the housing scheme, be 5s. 3d. per week, and the remainder 6s. 6d. per week, plus rates.

Tilbury U.D.C.—The county medical officer of health, Dr. Thresh, is to be asked to advise the council upon a site for the extension of the housing scheme.—A committee has been appointed to consider the desirability of giving instructions for the preparation of the necessary particulars and plans with a view of the council making an application to the Local Government Board for authority to prepare a town planning scheme for the urban district.

REFUSE COLLECTION AND DISPOSAL.

Oswaldtwistle U.D.C.—Proposals are under consideration for the installation of a new refuse destructor.

Sandgate U.D.C.—The surveyor, Mr. D. V. Howard, reported recently that, having received several complaints in regard to the scavenging, he saw the contractor, who had written saying that he was doing his best, but labour was very scarce. The chairman said the whole trouble arose through the high wages paid by the Government. Men were being paid on the camp 9½d. an hour. The people should burn their rubbish as much as possible. They could have bills printed and sent round, asking householders to burn as much as possible of their refuse. Councillor Pannell moved that a notice be sent round, asking the ratepayers to burn as much of their refuse as possible. The motion was carried.

ROADS AND MATERIALS.

Alton R.D.C. An arrangement has been reached with the Road Board for the repair of the Grayshott-Hedley and Bordon-Passfield roads.

Andover R.D.C.—The surveyor, Mr. J. Wormald, has received instructions to prepare estimates for the widening of the road leading from Hampshire Cross to Ufworth Station, part of the cost of which it is anticipated, will be met by the Road Board.

Barnsley T.C.—The borough surveyor, Mr. J. H. Taylor, has received instructions to proceed with the widening of Church-street as soon as the necessary demolitions have been effected.

Barnstaple R.D.C.—The council last week received a letter from the County Bridges and Main Road Committee stating that they had had a report from their surveyor that in order to obtain the best results out of the large expenditure on roads in the neighbourhood of Barnstaple prompt action in making small surface repairs was necessary. They asked that this work should not be contracted for, but done by good road labourers, employees by the day or hour. Opinions were expressed both for and against the proposal, and the question was referred to the Finance Committee.

Brigg U.D.C.—The surveyor, Mr. E. K. Clark, has been authorised to proceed with the diversion of a road at North Killingholme that is necessary for Government traffic.

Carmarthenshire C.C. Mr. Dudley Drummond drew the attention of the Main Roads Committee to an expenditure of £1,173 for improvements at Garnant, and said that in economy was the most necessary need of the day he thought the public should have an explanation why the original contract price of £954 had been exceeded by 122 per cent for extras. It was explained that in carrying out the contract the contractor came across an old colliery level whose existence was not known. It came down across the main road, and it was necessary, before a satisfactory foundation could be made, to rebuild and culvert the whole level.

Eastbourne R.D.C.—The council have agreed to spend £216 upon the repair of Exceat-road, and carry out such further repairs as may be necessary to satisfy the Road Board.

Falmouth T.C.—An intimation has been received that Lord Kimberley will give land for the construction of a road at Berkeley Cottages.

Hampton U.D.C.—The surveyor, Mr. S. H. Chambers, reported the receipt of a communication from the engineer of the Road Board, stating that the Road Board had been requested by the military authorities to arrange for the construction and repair of roads at the Kempton Park Military Transport Depot, and asking if he would undertake to carry out the necessary works. In view of the urgency of the matter, and after consultation with the chairman of the council and the chairman of the General Purposes Committee, he had agreed to undertake the work forthwith. He also reported that prior to this arrangement he had been requested by the Royal Engineers (Hounslow) to provide four men per day, and to let on hire the steam roller, at agreed prices, for fourteen days, for which he had entered into a contract on behalf of the council after consulting the clerk. An account, amounting to £33 10s. for the work, plus a sum for hire of tools, would be rendered. The Road Board had also purchased some 100 yds. of hardcore, and were hiring the steam roller and tools at agreed prices, and he had arranged that £1 per week of the foreman's wages should be borne by the Road Board. The action of the surveyor was approved, both as regards carrying out of the works and the sale of materials, and he was authorised to assist the Government and the Road Board in any way possible.

Hinckley U.D.C.—Consideration is being given to a proposal for the widening of Mill-street by the purchase of certain property which is in the market.

Isle of Wight R.D.C.—The clerk read correspondence between the council and the county council as to the amount of about £2,000 disallowed by the county council on the rural roads account, and said the subject had not been considered by the Roads Committee of the county council, although in one of the rural district council letters the clerk wrote that, failing a satisfactory reply, they would, with much regret, treat the matter as a difference which had arisen under the Act, and it would be necessary for them to appoint an arbitrator.—The chairman said that the county surveyor, in his annual report, evidently recognised the necessity for the increased cost of road maintenance. The matter was referred to the Roads Committee to appoint an arbitrator.

Maldens and Coombe U.D.C.—The surveyor, Mr. R. H. Jeffes, has been asked to prepare plans for making up part of George-road, Coombe, under the Private Street Works Act, 1892.—The amended tender of Messrs. J. Mowlem & Co. for making up part of South-lane has been accepted at £1,521.

Newport (Mon.) T.C.—Subject to a loan being sanctioned by the Local Government Board, it has been agreed to construct, at an estimated cost of £1,025, a new road near the site of the works to be built by the British Mannesmann Tube Company.

Oswestry R.D.C.—The surveyor, Mr. T. H. Davies, reported that there was considerable dissatisfaction among nearly all the road contractors about the smallness of the price they received for "siding" the roads. The present price, 16s. per mile, was fixed many years ago, and he thought it should be increased. The council agreed to increase the price from 16s. to £1 per mile.—The surveyor also reported that the test lengths of tar-macadam, near Maesbrook Station, had stood quite well. On the other hand, the newly-rolled water-bound road at Talysarn was severely damaged, and he advised that next year all places subject to flooding should be tar-macadamised.

Penrith R.D.C.—The surveyor, Mr. W. S. Lythgoe, reported that he had met the county surveyor at Greystoke, and looked over the road near Sharkie Bridge, which the council suggested might be taken over by the county. The county surveyor would recommend that the road be taken over if satisfactorily repaired in any of the following ways: (1) Relaid with Threlkeld metal, well steam rolled, and then tar-sprayed and gritted when thoroughly dry; (2) relaid with Threlkeld tar-macadam and finished off; (3) relaid with the council's own made limestone tar-macadam. As this was a short length of road the county surveyor agreed that it would be an excellent plan to try the last-named means as an experiment, both for county and district roads. The council, however, decided to defer the matter for the present.—With regard to snow cutting, the surveyor reported that, with a view to meeting complaints that too much was spent on this service, he had given written instructions to the men as to what had to be done after a snowstorm, and which roads had not to be touched. As this policy would probably lead to protests in some quarters he would like further instructions if necessary. The surveyor's action was approved.

Plomesgate R.D.C.—The surveyors have received instructions to prepare estimates of the cost of repairing certain roads in Framlingham which have been subjected to heavy military traffic.

Ramsgate T.C.—For the purpose of a road widening scheme it has been decided to purchase land in front of the Bull and George Hotel, High-street.

Richmond (Yorks) T.C.—The construction of a new road to the military camp is under consideration.

South Stoneham R.D.C.—The surveyor, Mr. F. Heather, reported that he had taken levels and was preparing plans to put the roads into proper condition. His rough estimate for one portion of the roads was £876, and for the other part £328. That worked out at 5s. 10d. per foot frontage in the lower part, and 1s. 11d. in the upper. If the cost was spread over the whole distance, which would be the right thing, then it worked out at about 3s. 10d. per foot. The council are asking for authority to carry out these works.

Tilbury U.D.C.—The surveyor, Mr. S. A. Hill-Willis, stated that owing to the war transport work at Tilbury Docks had considerably increased in volume and importance, and that this entailed a proportionate increase in heavy road traffic and the consequent wear and tear of the surface of the roads. It was essential in the national interests that this special traffic should be facilitated, rather than impeded, and for that reason it was impracticable for the council to make any reduction in their road maintenance expenditure in respect of the principal highways. On the other hand, it was obviously unreasonable that the whole of this additional expenditure (which was for national purposes) should fall upon the local ratepayers, but rather that it should be borne by the National Exchequer. He therefore recommended that a special grant be applied for on the council's behalf, which would give a good standard of road maintenance without additional cost to the ratepayers within the urban area. The report was adopted, and it was decided to write to the Road Board and ask for a grant on behalf of the expenditure on the main roads.

Westmorland C.C.—Mr. G. H. Pattinson, on behalf of the Main Roads Committee, stated that when the estimates of this year's expenditure on the main roads were prepared everything but what was absolutely needful for keeping the roads passable was left out. This year they had tar-sprayed only 67,129 yds., at a cost of £520, whereas last year they did 311,744 yds.; on this item, consequently, there had been a saving of £1,895. By deferring other work on roads in the Lake District and elsewhere there was a saving of £1,469.

Wincanton R.D.C.—The surveyor for No. 2 district, Mr. E. Padfield, included in his estimate for the repair and maintenance of the main roads for the ensuing year the surface tarring of 8½ miles, comprising the most important roads in the parishes of Castle Cary, Bruton, Pitcombe, Shepton Montague, Ansford, Lovington, Alford, North Cadbury, Sparkford, and Queen Camel. He said that, in his opinion, the surface tarring of a road provided the work is well done, and in suitable weather, prolongs the life of the road from 25 per cent to 50 per cent. As to recoat a mile of road 6 yds. in width cost approximately £640, while to surface tar a mile of the same width cost only £60 10s., the economy of the latter was obvious. He considered it unnecessary to break up roads, remetal and steam-roll them, simply because they have a bumpy surface, but if they were patched with tar-macadam and surface tarred, the metal that was now on the roads would be preserved, a good surface would result, and the life of the road prolonged at a much less cost. The council approved of the estimate.

SEWERAGE AND SEWAGE DISPOSAL.

Arklow U.D.C.—The surveyor, Mr. L. O'Toole, has reported that the cost of making a reinforced concrete auxiliary sewer at Togher would be £400. The council will consider the matter at their next meeting.

Bourne R.D.C.—Negotiations are pending with the parish council with respect to a sewerage scheme for Corby.

Brackley R.D.C.—It is proposed to carry out drainage works at Thenford, at an estimated cost of £120.

Leyburn R.D.C.—A committee has been appointed to report upon the condition of the Middleham sewage disposal works.

Paisley T.C.—The Scottish Office have again written to the town council calling attention to the pollution of the Clyde by sewage from Paisley, and a reply has been forwarded stating that the town council were not losing sight of the matter.

WATER, GAS, AND ELECTRICITY.

Cardiff T.C.—The Waterworks Committee have adopted a scheme for pumping from the Ely, estimated at £50, for the purpose of supplementing the water supply from Taff Fawr.

Chesterfield T.C.—It is proposed to provide additional electricity plant, at an estimated cost of £1,800, and to instal coke-breeze burning apparatus in connection with four additional boilers, at a cost of £219.

Clones U.D.C.—A scheme is being considered for improving the water supply.

Harrogate T.C.—A scheme has been approved for extensions to the electric mains.

Hinckley U.D.C.—The council have approved a report for extensions of the water mains in New-street and Wellsland.

Hythe T.C.—An arrangement has been reached with the War Office to supply Dibgate Camp with 90,000 gallons of water daily, at 1s. per 1,000 gallons.

Keighley T.C.—An agreement has been made for pumping water from a well belonging to the Fleece Mills Company into the Black Hill reservoir.

Skegness U.D.C.—The necessary notice has been given of the intention of the council to purchase the local gas undertaking.

MISCELLANEOUS.

Acton U.D.C. Seven assistants in the surveyor's department joined the Forces recently. Three remaining ones have enlisted under Lord Derby's scheme. The whole of the workmen under the council of serviceable age have also joined in connection with the last-named movement.

Chesterfield T.C.—It is intended to purchase a steam wagon, with tipping gear, at a cost of £590.

Hampton U.D.C.—It has been agreed to pay to Messrs. Keves & Shepherd the following advanced prices for farriery: Shoeing, 5s. per set; laying and steeling picks, 1s. 6d.; re-steeling picks, 10d; and sharpening picks, 3d.

Yarmouth T.C.—Upon the advice of the borough surveyor, Mr. J. W. Cockrill, it has been decided to construct a groyne for the protection of the north beach.

Companies Allowances for Reduced Lighting.—The return on this subject, which, as stated in our issue of last week, has been prepared by Mr. B. J. Wormleighton, surveyor to the Loftus, Yorks, Urban District Council, will appear next week.

THE ROAD BOARD.

NEW OFFICES.

The offices of the Road Board will, as from December 28th, be moved from Queen Anne's Chambers to 35 Cromwell-road, S.W. (two minutes from South Kensington Station). Telephone 4136 Kensington.

FOR OTHER ADVERTISEMENTS
See End of Paper.

BOROUGH OF MORECAMBE.
APPOINTMENT OF TEMPORARY BOROUGH SURVEYOR.

The Town Council of the Borough of Morecambe invite applications from qualified persons ineligible for military service for the temporary appointment of Borough Surveyor, as substitute for the Borough Surveyor on active service.

Applications, under seal, endorsed "Temporary Borough Surveyor," accompanied by three testimonials, and stating salary required, to be delivered to me not later than 3rd January, 1916.

WM. TILLY,
Town Clerk.

Town Hall, Morecambe. (2,801)

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Bradford T.C. (December 14th. Mr. R. C. Maxwell).—This was an inquiry into an application for a Provisional Order to extend the operation of the smoke clause of the Bradford Corporation Acts, 1910 and 1913, which otherwise would cease to be operative at the end of this year.—The town clerk, Mr. Frederick Stevens, stated that for many years the atmosphere had been grossly polluted by smoke. During the last six or seven years a great deal of consideration had been given by the Health Committee to the subject of prevention of the atmospheric pollution. The committee considered this subject as one of the utmost importance in regard to the general health of the population, and were prepared to spare no effort to bring about a purer and cleaner atmosphere in the city. The general effects of the smoky atmosphere in Bradford might be briefly stated to be three in number. It had contributed materially and directly to the higher mortality from respiratory diseases which had been noted in the vital statistics of the city. The average annual mortality in England and Wales from bronchitis and pneumonia for the five years ended December, 1911, was 2·28 per 1,000; in Bradford for the same period the average was 2·12; for the same period the average annual death-rate from tuberculous phthisis was, in England and Wales, 1·08, and in Bradford it was 1·16 per 1,000. The general effect on domestic hygiene of a smoky atmosphere was most deleterious. Cleanliness of the house without inordinate labour could not be maintained, and the constantly recurring dirty conditions had a most prejudicial effect on the minds of the inhabitants in many of the dwellings in the more grimy districts of the city. The dirty condition of the atmosphere was a direct incentive to prevent that free ventilation of the dwellings which is so necessary in the interests of health. The general effect of smoke on the buildings and vegetation prevented the full development of those desirable amenities of the outside of the house such as fresh painting of woodwork, and allotments and cottage gardens, all of which had a distinctly elevating influence on the population. In view of the desire of the Government that expenditure should be curtailed as much as possible the corporation decided in October last not to promote the Bill, but merely to seek an extension of time for the exercise of their powers. By adopting this course it was anticipated that serious opposition, involving the expenditure of time and money, would be avoided.

Kingston (Surrey) T.C. (December 15th. Mr. P. M. Crosthwaite).—£16,792 for the purposes of the municipal electricity undertaking. The inspector took exception to the practice of spending capital monies in excess of the council's borrowing powers without the sanction of the Local Government Board, and intimated that the utmost to be looked for was sanction to such a loan as was called for by the corporation's immediate requirements. The inquiry extended over two and a half hours.

APPLICATIONS FOR LOANS.

Bolton T.C.—£2,215 for electricity mains and transformers.

Kingstown U.D.C.—£23,500 for the provision of working class dwellings.

Sheffield T.C.—£137,104 for additional electricity plant.

South Shields R.D.C.—£325, excess of Boldon sewerage works.

LOANS SANCTIONED.

Hornsey T.C.—£500 for electricity mains.

Marylebone B.C.—£3,800 for electricity mains and house services.

Stratford-on-Avon T.C.—£400 for the provision of dehydrating plant.

FORTHCOMING INQUIRIES.

JANUARY.	£
24.—**Tottenham.** For the purchase of land for a hospital (Dr. W. W. E. Fletcher)	8,643
31.—**Ellesmere Port.** For the purpose of road widening (Mr. P. M. Crosthwaite) ...	—

PERSONAL.

Mr. A. E. Lloyd, borough surveyor and sanitary inspector, Higham Ferrers, has been elected a member of the Royal Sanitary Institute.

Mr. Joseph Mitchell, borough surveyor of Hyde (on the town's incorporation in 1881 up to six or seven years ago, died recently at Birkdale, Southport, at the age of seventy-six.

Mr. S. F. Clare, surveyor to the Stanford Urban District Council, has obtained sanction to enrol under Lord Derby's scheme, the council agreeing to pay the usual allowances when he is called up.

Messrs. James Maden, Trust engineer, Calcutta, and John Taylor, borough engineer, Walsall, have been elected members, and Messrs. S. Bressey Edwards, city engineer's office, Liverpool, James Garvie, Westminster City Hall, Charles Greenwood, borough engineer's department, St. Helens, and D. A. Howell, resident engineer, Llanelly waterworks, associate members of the Institution of Civil Engineers.

Mr. Frank Latham, borough engineer of Penzance, and a past-president of the Institution of Municipal Engineers, has received officially the following message with respect to his brother, Lance-Corporal Latham, of the London Scottish, who was killed in action in France: "His Majesty the King records the gallant and distinguished service of Lance-Corporal H. G. Latham in the field. His Majesty desires to express his high appreciation of the services of the late Lance-Corporal H. G. Latham."

Mr. J. E. Acfield, chief assistant in the city engineer's office, Leeds, has received a commission as 2nd Lieutenant in the Royal Engineers. The following members of the staff have enlisted for active service since the issue of the list last on July 22nd: H. C. Watson, pupil, 1/1st Home Counties Divisional Cyclist Corps; J. B. Holmes, clerk, Royal Engineers; M. Fagan, enquiry clerk, National Reserve; W. J. Walker, assistant building surveyor, 2nd West Yorkshire Regiment; A. Butler, clerk, R.A.M.C. The following have enlisted under Lord Derby's scheme: F. W. Hey, engineering assistant; R. V. Hamer, engineering assistant; G. Holmes, architectural assistant; W. H. Russell, surveying assistant; and H. Turpin, T. Rushton, R. Mather, H. Ross, and A. Tetley, clerks. Out of a total of thirty-nine who were eligible for enlistment, twenty-five are serving with H.M. Forces, nine have enlisted under Lord Derby's scheme, and four have been rejected as medically unfit, leaving only one who has not offered his services.

INSTITUTION OF MUNICIPAL ENGINEERS.

NORTHERN DISTRICT.

The annual meeting of the Local Section will be held on Saturday, January 29, 1916. Full programme will be issued later.

WM. WALLIN,
Hon. District Secretary.

Newcastle-on-Tyne.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 3.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of vacancies. Such advertisements may, in cases of emergency only, be telephoned (City No. 1056) subject to later confirmation by letter.*

SURVEYOR'S CLERK.—December 31st.—Aldershot Urban District Council.—Mr. Fred. H. Dominey, acting clerk, Municipal Buildings, Aldershot.

SURVEYOR AND INSPECTOR.—December 31st.—Mayfield (Staffs) Rural District Council. £100 per annum.—Mr. R. Holland, clerk, Ashbourne, Derbyshire.

TEMPORARY ASSISTANT SURVEYOR.—January 1st.—County Council of Devon.—Mr. W. P. Robinson, county surveyor (No. 2 Division), 22 Queen-street, Exeter.

SHIFT ENGINEER.—January 1st.—Chertsey Rural District Council. 30s. per week.—Mr. L. Porter, assistant clerk, 80 Guildford-street, Chertsey.

SANITARY SUB-OFFICER.—January 3rd.—Corporation of Dublin. £78 per annum.—Mr. C. A. Cameron, Executive Sanitary Officer, Municipal Buildings, Dublin.

ASSISTANT ENGINEERS.—April 1st. — Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1056) subject to later confirmation by letter.*

Buildings.

DARTFORD.—December 30th.—For the erection of thirty houses, for the urban district council.—The Surveyor, Council Offices, Dartford.

PRESTWICH.—January 4th.—For the construction of a brick culvert, 2 ft. internal diameter, for the urban district council.—The Surveyor, Chester Bank, Prestwich.

BARKING.—January 7th.—For the erection of a steel-framed building covered with corrugated iron, together with brick-lined engine well, and appurtenant works, for the urban district council.—Mr. R. A. Lay, acting surveyor, Public Offices, Barking.

GREENOCK.—January 8th.—For the erection of cottages and the construction of streets and sewers, for the corporation.—Burgh Surveyor, Municipal Buildings.

Engineering: Iron and Steel.

BURY.—December 27th.—For the supply of iron castings, for the Bury and District Joint Water Board.—Waterworks Manager, Parsons-lane, Bury.

LONDON.—December 29th.—For the supply of 500 dustbins and 200 Waterloo coal hods, for the Commissioners of Works.—Controller of Supplies, Office of Works, 18 Queen Anne's-gate, Westminster, S.W.

TORQUAY.—December 29th.—For the provision and erection of plant for dehydrating coal tar, for the corporation.—Mr. F. Chambers, gasworks engineer.

JOHANNESBURG.—December 30th.—For the supply and erection of ice-making and refrigerating plant, for the municipal council. — Intelligence Branch of the Board of Trade, 73 Basinghall-street London, E.C.

DURBAN.—December 31st.—For the supply of telephone apparatus and materials, underground cables, and cast-iron pipes, for the Telephone Department.—Messrs. Webster, Steel & Co., London Agents, 5 East India-avenue, E.C.

NEWTON-IN-MAKERFIELD.—January 3rd.—For the supply of two Lancashire boilers, a steam-driven gas exhauster, a direct-current set of 25-horse-power, cast-iron gas mains and specials, excavating trenches, erection of a boiler-house, and the construction of a reinforced-concrete tar and liquor well, for the urban district council.—Mr. R. T. Surtees, gas engineer, Gasworks, Newton-le-Willows.

GOSPORT.—January 4th.—For the supply of a flywheel, crank shaft, steam, and air eccentrics and spindles, for the urban district council.—Engineer and Surveyor, Town Hall, Gosport.

PORTLAND.—January 5th.—For overhauling and repairs to a set of three-throw deep-well pumps, fixing a set of engine gearing, and other works, for the Waterworks Committee.—Mr. A. S. Lilley, engineer and surveyor, Council Offices, New-road, Portland.

THURSO.—January 8th.—For the construction of concrete work at the west pier, for the Harbour Trustees.—The Clerk, Traill-street, Thurso.

ST. PANCRAS.—January 10th.—For steel constructional work, for the borough council.—Mr. C. H. F. Barrett, town clerk, Town Hall, Pancras-road, N.W.

VICTORIA (Australia).—January 12th.—For the supply of steel rails and fishplates, for the Agent-General for Victoria.—Messrs. John Coates & Co., 115 Victoria-street, London, S.W.

DARLINGTON.—January 12th.—For the supply and erection of coal bunkers and elevators, for the corporation.—Electrical Engineer, Electricity Works, Haughton-road, Darlington.

SOUTHAMPTON.—For the supply of 3 tons of [illegible] cylinder, 5 tons of steel cylinder, and 1 ton [illegible] pump, and hanging rods, for the corporation Waterworks Engineer, 33 and 35 French-street, Southampton.

Roads.

HERTS.—December 27th.—For the supply of broken [illegible] and macadam required for the main roads, for the county council.—Mr. J. S. Killick, county surveyor, County Surveyor's Office, Hatfield.

SURBITON.—December 29th.—For the supply of refined or distilled tar, for the urban district council. The Surveyor, Council Offices, Ewell-road, Surbiton.

SOMERSET.—December 30th.—For surface tarring on main roads at various places, for the county council.—Mr. Gordon R. Folland, acting county surveyor, County Surveyor's Office, Wells.

CANNOCK.—December 31st.—For the supply of refined tar prepared in accordance with the specification of the Road Board, for the urban district council.—Mr. R. Blanchard, engineer and surveyor, Council Offices, Cannock.

LYDD.—December 31st.—For the supply of 200 barrels of tar, for the corporation.—Mr. T. Kettle, borough surveyor.

BRENTFORD.—January 1st.—For the supply of 12,000 gallons of distilled tar, for the urban district council.—Mr. J. W. Croxford, surveyor, Clifden House, Boston-road, Brentford.

NORTH RIDING.—January 5th.—For team labour and hauling, and macadam and steam rolling, for the county council.—Mr. W. G. Bryning, county surveyor, County Hall, Northallerton.

ISLE OF WIGHT.—January 5th.—For the supply of 150 tons of 1½-in. granite, for the rural district council.—The Surveyor, Newport, I.W.

DORSET.—January 7th.—For the supply of broken granite, basalt, quartzite, limestone, and tar-macadam, for the county council.—Mr. E. H. Habgood, acting county surveyor, County Offices, Dorchester.

BOURNE.—January 8th.—For the supply of 6,000 tons of granite and 2,000 tons of slag, for the rural district council.—Mr. T. Lake, district surveyor, Bourne, Lincs.

BEXLEY.—January 11th.—For the supply of tar, highway materials, stoneware pipes, and Portland cement, for the urban district council.—Mr. W. T. Howse, surveyor, Council Offices, Bexley Heath.

SURREY.—January 17th.—For the supply of high-class materials, such as granites, basalts, limestone, slag, tar-macadam, pitch, tar, tar oils, flints, fine gravel, haulage, and hire of steam rollers and water carts, for the county council.—Mr. A. Dryland, county surveyor, County Hall, Kingston-on-Thames.

HERTS.—January 31st.—For the supply of hand-picked surface flints, dug gravel, hoggin, shingle, sand, and team labour, for the county council.—Mr. J. S. Killick, county surveyor, County Surveyor's Office, Hatfield.

Sanitary.

STONE.—December 27th.—For the removal of house refuse, for the rural district council.—Mr. W. W. Wynne, clerk, 21 High-street, Stone, Staffs.

LONDON.—December 28th.—For the removal of refuse from car sheds and other depots, for the London County Council.—Chief Officer, London County Council Tramways, 62 Finsbury-pavement, E.C.

MUTFORD.—December 29th.—For the removal of house refuse and night soil, for the rural district council.—Mr. W. B. Forward, clerk, 148 London-road, N. Lowestoft.

Stores.

DOUGLAS.—December 27th.—For the supply of sundry stores, for the corporation.—Borough Surveyor, Douglas, Isle of Man.

DOVER.—December 28th.—For the supply of materials and labour, for the corporation.—Mr. R. E. Knocker, town clerk, 69 Castle-street, Dover.

OTLEY.—December 31st.—For the supply of setts, kerbs, flags, granite macadam, pitch, tar, slag dust, tar-macadam, limestone macadam, and brushes, for the urban district council.—Mr. C. F. Hodgson, surveyor.

SUNDERLAND.—December 31st.—For the supply of street lamps, fire hydrants, road gullies, manhole covers, asphalting, kerbing, sanitary pipes, and disinfectants, for the rural district council.—The Surveyor.

HASTINGS.—January 3rd.—For the supply of manhole covers, brooms and brushes, for the corporation. Mr. P. H. Palmer, borough engineer, Town Hall.

ST. PANCRAS.—January 10th.—For the supply of cartage, timber and joinery materials, Jarrah wood blocks, barrows, trucks, handles, paints, oils, smiths' and founders' works, general ironmongery, tools and other hardware goods, Yorkshire stone and artificial paving slabs, granite kerbs, paving setts, broken granite, Kentish rag, gravel and other road materials, lime, cement, bricks, stoneware pipes and other glazed goods, bass brooms, horse brush stocks, tarpaulins, hemp and rubber goods, pitch, tar, creosote oil, removal of road sweepings, horsing water vans, and horsing road-sweeping and other machines, for the borough council.—Mr. Nisbet Blair, borough engineer and surveyor.

PLYMOUTH.—January 15th.—For the supply of paints, varnishes, ironwork, petroleum oil, broomheads, household brushes, rope, iron, steel, pitch-pine, deals, flooring, carbolic powder, Portland cement, lubricating oils, fuel oil, tar, pitch, painters' brushes, explosives, soap, softwood-blocks, creosote, disinfectant fluid, granite kerbs, setts, white lead, red lead, linseed oil, turpentine, turpentine substitute, refilling machine-revolving brooms, benzoline, motor spirit, tools, indiarubber goods, hose, and ship chandler's goods, for the corporation.—Mr. James Paton, borough engineer and surveyor, Municipal Offices, Plymouth.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.
‡ Provisionally accepted.

CAMBRIDGE.—For the supply of broken granite, syenite, and basalt, or similar stone, for the corporation.—Mr. J. Julian, borough surveyor:—

Enderby Granite Company, Enderby.
Mountsorrel Granite Company, Mountsorrel.

CLEETHORPES.—For the supply of 200 tons of slag chippings, for the urban district council.—Mr. L. W. Pye, acting surveyor:—

Slag Chippings.—J. R. Mitchell & Co., Limited, and Torry & Butlin, Grimsby, at 5s. 4d.
Oats.—W. Maltby, Cleethorpes, and A. Marshall, Humber stone, at £1 15s. per quarter.

STOCKPORT.—For manual and team labour, and materials required in repairs to footpath, and supplying and fixing wooden piling, for the corporation.—Mr. J. Atkinson, borough surveyor:—

M. Lane, Stockport, £267.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JANUARY.

5.—Institute of Sanitary Engineers: Presidential Address.
29.—Institution of Municipal Engineers: Northern District Annual Meeting.

FEBRUARY.

2.—Institute of Sanitary Engineers: Dr. Gilbert J. Fowler on "The Activated Sludge Process of Sewage Purification."

APPOINTMENTS OPEN.

ALDERSHOT URBAN DISTRICT COUNCIL.
SURVEYOR'S CLERK.

The above Council requires the services of a Clerk, male or female (the male must be ineligible for military service), in the Surveyor's Department.

A shorthand writer and typist, and one experienced in the keeping of accounts of such a department, and capable of preparing tracings preferred.

Applications, stating age, experience, and wages required, together with copies of 3 testimonials, to be sent to the Surveyor on or before 31st inst., endorsed "Surveyor's Clerk."

FRED. H. DOMINEY,
Acting Clerk.

Municipal Buildings,
Aldershot.
December 15, 1915. (2,793)

COUNTY COUNCIL OF DEVON.

MAIN ROADS AND BRIDGES DEPARTMENT (No. 2 DIVISION).

Applications are invited for the appointment of Temporary Assistant Surveyor for the duration of the War. Candidates must not be eligible for service in the Forces, and must have had practical experience in the construction and maintenance of Roads and Bridges. The person appointed must also provide and use a Motor Cycle in the service of the Council, for which an allowance will be made.

Particulars of the duties and terms of appointment can be obtained from the undersigned, to whom applications should be sent not later than 1st January, 1916.

W. P. ROBINSON, ASSOC.M.INST.C.E.,
County Surveyor (No. 2 Division).
22 Queen-street,
Exeter. (2,798)

TENDERS WANTED.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SAINT PANCRAS BOROUGH COUNCIL.

The Highways, Sewers and Public Works Committee of the Council of the Borough of St. Pancras invite Tenders from persons willing to execute Contracts for the Work or Materials below described for one year, commencing 1st April, 1916.

Tenders, under endorsed covers (supplied), to be delivered at the Office of the Department of Works, at the Town Hall, Pancras-road, N.W., not later than 12 o'clock noon on Monday, the 10th January, 1916.

1. Removal of Road Sweepings and Gully Soil.
2. Horsing Water Vans.
3. Horsing Road-sweeping and other Machines.
4. Cartage.
5. Timber and Joinery Materials.
5b. Jarrah Wood Blocks.
6. Barrows, Trucks, Handles, &c.
7. Paints.
8. Oils.
9. Candles and other Chandlery.
10. Smiths' and Founders' Works.
11. General Ironmongery.
12. Tools and other Hardware Goods.
13. Yorkshire Stone and Artificial Paving Slabs.
14. Granite Kerbs, Paving Setts, Broken Granite and Kentish Rag.
15. Gravel and other Roadway Materials.
16. Sundry Materials (Lime, Cement, Bricks, Stoneware Pipes, and other Glazed Goods).
17. Bass Brooms and Horse Brush Stocks.
18. Tarpaulins, Hemp and Rubber Goods.
19. Pitch, Tar, Creosote Oil, Carbolic Powder, and Coke.

No Tender will be considered unless made out on one of the printed Forms, without any alteration thereof, which, with any further particulars, can be obtained on application to Mr. Wm. Nisbet Blair, M.INST.C.E., Borough Engineer and Surveyor, up to the morning of the said Monday, the 10th January, 1916.

The Council do not bind themselves to accept the lowest or any Tender.

Intending Contractors are not required to attend the Committee.

(By order)
C. H. F. BARRETT,
Town Clerk.

Town Hall, Pancras-road, N.W.
December 21, 1915. (2,800)

BOROUGH OF PLYMOUTH.

NOTICE IS HEREBY GIVEN that after the expiration of 10 days from the date hereof the Corporation intend to enter into Contracts for the Supply of the following Goods and Materials for one year:—

Schedule No. 3.—Section A.—Paints.
Section B.—Varnishes.
.. ,, 5. Ironwork.
.. ,, 7.—Petroleum Oil.
,, ,, 8.—Broomheads.
.. ,, 9.—Household Brushes.
,, ,, 10.—Rope.
,, ,, 11.—Iron and Steel.
.. ,, 13—Pitchpine, Deals, Flooring, &c.
.. ,, 14.—Carbolic Powder.
.. ,, 15.—Portland Cement.
.. ,, 16.—Section A.—Lubricating Oils.
Section B.—Fuel Oil.
.. ,, 17.—Tar and Pitch, includes refined for use in the construction of tarred macadam roads and for tar-spraying.
.. 18. Painters' Brushes.
.. ,, 19.—Explosives.
.. ,, 22. Soap (Yellow, Carbolic, Toilet, Soft).
.. ,, 23.—Wood Blocks, Soft.
.. ,, 24.—Creosote.
.. ,, 28.—Disinfectant Fluid.
.. ,, 29.—Granite Kerbs, Setts, &c.
.. ,, 30.—White Lead, Red Lead, Linseed Oil, Turpentine and Turpentine Substitute.
.. ,, 31.—Refilling Machine Revolving Brooms.
.. ,, 33.—Benzoline and Motor Spirit.
.. .. 34. Tools.
.. ,, 35.—Indiarubber Goods, Hose, &c.
.. ,, 36.—Ship Chandlers' Goods (Sundry Oils, Waste, Grease).

With the exception of Schedules 4, 17, 19, 21, 23 to 29 inclusive, 31, 32, 37, 38, the Schedules include for the Supply and Delivery of Materials to Wrangaton Station, Great Western Railway, about 13 miles from Plymouth, for the Plymouth Borough Asylum.

Tenders must be based on the whole of a Schedule (with the exception of Schedules Nos. 3, 4, 16, 21, 22, 26, 29 and 36), and not on any particular item contained therein.

(Separate Tenders will be considered for Sections A and B of Schedule No. 3, also Sections A and B, Schedule 16, and Section A, B, C, Schedule 26.)

Schedules may be obtained on payment of a deposit of £1 in cash for each Schedule. The deposits on the Schedules will be returned, provided *bona-fide* Tenders are received on or before the 15th January, 1916. Should the Contractor withdraw his Tender, or fail to send in one, the amount of his deposit will be forfeited, and the Contractor who applies for the Schedules must do so on the distinct understanding that he is willing to abide by the terms of this advertisement.

The lowest or any Tender will not necessarily be accepted.

Tenders to be delivered not later than Saturday, January 15th, 1916, addressed to the undersigned.

JAMES PATON,
Borough Engineer and Surveyor.

Municipal Offices,
Plymouth.
December 15 1915. (2,796)

BLAST FURNACE SLAG
From 14 cwt. to 24 cwt. per cubic yard.

FOR **SEWAGE FILTERING**
Supplied from ¼ in. upwards free from dust, requires no washing. PROVED AFTER 7 YEARS' WORKING not to disintegrate, and to give excellent effluent.

FOR **CONCRETE**
Tramways, Paving, Paving in Situ, Fireproof Floors, Building Construction, Door Steps, Landings, Window Heads, Engine Beds, &c. &c.

FOR **HIGHWAYS & BALLAST**
Construction of Roads, Repairs, Pitchings, Wall Building, Grotto Work. Railway Ballast.

OLD, HARD, DENSE. Made Fifty Years.
FOR **TAR MACADAM**

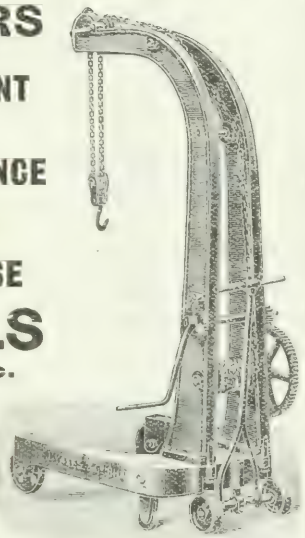
JOHN FREAKLEY & CO., Ltd., Coneygre Slag Works, DUDLEY PORT, TIPTON.
Telegrams—"Freakley, Tipton." Telephone—No. 3 Tipton.

JOHN **YATES** & CO. LTD.

Aston Manor, BIRMINGHAM.

TELEGRAMS: "YATONIAN, BIRMINGHAM."
TELEPHONE: BIRMINGHAM EAST 400.
(Private Branch Exchange.)

MAKERS of **PERMANENT WAY, MAINTENANCE** and **POWER-HOUSE TOOLS** &c. for **TRAM and RAILWAYS**



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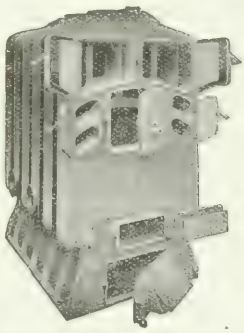

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Write us or 'Phone to Holborn 5138 for Quotation.

GRANOMAC

Ceiriog Granite Company, Ld., Chirk, North Wales.

MANUFACTURERS OF

Granite Tar Macadam
(Under the Trade Name of Granomac).

Road Metal
Concrete Flags,
&c.

QUARRIES:
Glynceiriog, Denbighshire,
AND
Blodwell, Salop.

Trial Length of Main Road, laid in 1911 with Granhams Moor Tar Macadam.
(Shropshire County Council.)

Ceiriog Granomac has been used by the following County Councils:

BUCKINGHAM.
CHESHIRE.
DENBIGH.
LANCASHIRE.
MONTGOMERY.
SALOP.
STAFFORD.

Granhams Moor and Breidden Tar Macadam has been used by the following County Councils:

BUCKINGHAM.
MONTGOMERY.
SALOP.
WARWICKSHIRE.

GRANHAMS MOOR QUARRY CO., Ld.

8, CHURCH STREET, SHREWSBURY.

Manufacturers of **Granite & Quartzite Tar Macadam & Road Metal**

QUARRIES—BREIDDEN HILL GRANITE, MONTGOMERYSHIRE; GRANHAMS MOOR QUARTZITE, PONTESBURY, SALOP.

SURREY COUNTY COUNCIL.

MAIN ROADS UNDER DIRECT COUNTY MANAGEMENT.

MATERIALS, HAULAGE AND STEAM ROLLING.

Tenders are invited:—

(*a*) For the Supply of High-class Materials, such as Granites, Basalts, Limestone, Slag, Tar-macadam, Pitch, Tar and Tar Oils, delivered at Railway Stations; also for Flints and Fine Gravel for footpaths, delivered either at Stations or at the roadside;

(*b*) For Haulage Work from Railway Stations, and also for Day-work upon the several Main Roads; and

(*c*) For the Hire of Steam Rollers and Water Carts in the various districts in the County where the roads are under "Direct Control" of the County Council, for the year ending 31st March, 1917.

Specifications, Schedules, and Forms of Tender may be obtained from the County Surveyor, County Hall, Kingston-on-Thames, to whom Tenders must be sent in sealed and endorsed envelopes so as to reach his Office on or before the 17th day of January, 1916.

(By order)

A. DRYLAND,
County Surveyor.

County Hall,
Kingston-on-Thames.
December 21, 1915. (2,799)

Later Official and Personal Advertisements (if any) will be found in the literary pages of the paper.

APPOINTMENTS WANTED.

CIVIL ENGINEER, Surveyor, 34, ineligible Army, experienced Railways, Bridges, Road Construction, Buildings, Drainage, Setting Out, Measuring up Works and Contracts, Book-keeping, desires permanent post.—Box 1,551, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (2,797)

STOP SHOVELLING COAL AND £ S. AND D.

Send **1/11** for a scientific device for saving coals and obtaining the maximum amount of HEAT.

"MUSHROOM SPIRALS"

fits all kinds of Grates and Kitcheners.

NO FIXING!
NO TROUBLE!
NOT VISIBLE!

MONEY REFUNDED IF NOT SATISFIED AFTER 7 DAYS' TRIAL.

This is the latest and best means of effecting economy. Not to be confused with bricks and iron arrangements.

THE MAXIMUM COMPANY,
28 VICTORIA STREET, LONDON, S.W.
Telephone: Victoria 5241.

Chief Offices:—352 to 364 Euston Road, London, N.W.

Telegrams: 'Courteous, Eusroad, London.' Telephone No.: Museum 3032 (5 lines.)

SPECIAL ISSUE

OF

"THE SURVEYOR."

January 28th, 1916.

Security LONDON & LANCASHIRE FIRE INSURANCE COMPANY LTD £6,107,594

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Consequential Loss.
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THE LONDON LOAN & DISCOUNT COMPANY, LIMITED,
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Telephone: CENTRAL 3180. Nr Mansion House

Local Government Officials financially accommodated with their investments, Insurances and general requirements with easy repayments over an extended period.

For terms and particulars apply—MANAGER.

LUMINOUS PAINT.

Dr. Bachmann's Luminous Paint, awarded gold medals at the Fisheries and Healtheries Exhibitions, London, 1883-84, is now being used by Borough Councils for painting lamp-posts to prevent accidents at night.

Sole Manufacturer—
W. C. HORNE, North Cheam, Surrey.

N.B.—Enquirers kindly mention this Journal.

The Surveyor

And Municipal and County Engineer.

Vol. XLVIII. DECEMBER 31, 1915. No. 1,250.

Minutes of Proceedings.

Disposal of Suspended Matter in Sewage.

This heading has been taken from an article in a recent issue of our contemporary the *Canadian Engineer*, as it very aptly describes the paper, by Mr. Rudolph Hering, D.Sc., of New York, to which it refers. After setting forth a description of sewage, and the chemical and biological actions which are caused by the decomposition of the organic matters in suspension, Mr. Hering states very clearly the most satisfactory conditions under which the collection and delivery of the sewage should take place. From the extracts, which we print elsewhere, it will be seen that he is in favour of omitting intercepting traps and ventilating sewers through the house drains and soil vent-pipes. He states that this practice has been found very advantageous, and is increasing in cities in America and the Continent of Europe. Although very little is heard of it, we believe the practice is being adopted in a number of instances in this country, in spite of our innate conservatism and the tendency of sanitary officials to adhere rigidly to the strict letter of out-of-date by-laws. On the other hand, he has a good word to say for the custom in this country of providing ample flushing arrangements, not only at the heads of sewers, but also on the larger sewers which have sluggish gradients, and he considers that the adoption of similar methods in America would improve their sewerage systems.

Several arrangements for maintaining the supply of oxygen in sewer air in order to prevent putrefaction are discussed, and Mr. Hering then emphasises his earlier statement that, in order to secure the sanitary disposal of sewage, it must be placed under conditions that its decomposition will be facilitated by contact with oxygen, or, in the absence of oxygen, by such combinations of hydrogen as will produce no offensive odours. This confirms the statements we have made on several occasions that the present-day tendency is to avoid putrefactive fermentation as far as possible in treating the liquid sewage, and to produce such conditions in the process of dealing with the solids, in the form of sludge, that *offensive* putrefaction shall be avoided. This leads up to a description of the Travis and Imhoff tanks, with a discussion of the relative merits of "deep double-deck Imhoff tanks" and "two shallow single-deck tanks," side by side. Under the term "double-deck" are included tanks of the Travis and Imhoff type in which the decomposition of the sludge takes place in a chamber separated from the main flow of the sewage, which is thus not fouled by the products of decomposition. Under the alternative method the settling out of the solids takes place in one shallow tank, and the deposited sludge is regularly removed into another separate tank for further decomposition. The details of the various processes which take place, and the peculiar conditions which are set up under these various methods are extremely interesting and provide valuable information well worthy of careful study.

In conclusion, Mr. Hering discusses the various experiments which have been carried out in recent years on the methods of forced aëration, and the activated sludge process; but the reports upon this work which have recently been published, both here and in America, were evidently not known at the time when Mr. Hering prepared his paper. In conclusion, he points out that the answer to the question as to whether the inoffensive disposal of sewage solids can be most satisfactorily carried out by aërobic decomposition as in the activated sludge process, or by inoffensive anaërobic decomposition as in the Imhoff tank system, will depend upon the element of comparative cost of the two methods in securing and maintaining the desired unobjectionable conditions.

* * *

Repairing Brick Sewers and Aqueducts.

There are now two methods by which successful results have been obtained in the coating of brickwork and masonry with cement and concrete mechanically. These two methods are the cement gun process and that in which the concrete atomiser is used. The cement gun is fairly well known as being a means by which cement and sand are mixed and forced out of a nozzle under air pressure, so as to be applied to any surface which has to be rendered. The concrete atomiser, on the other hand, is an appliance by which concrete may be sprayed into place, the fluid concrete being blown out through a nozzle by the force of superheated steam. One has to look to America for descriptions of such work, although the cement gun is coming into use in this country. *Engineering News* of New York, in a recent issue, contains two articles dealing respectively with the two methods, while a full description of the concrete atomiser appeared in the same journal on October 14, 1914.

In the article which appeared recently a description is given of the lining of two 5-ft. diameter water-power tunnels. These tunnels, being about 100 years old, had a rough and imperfect interior surface, the mortar having been washed out of the masonry joints. The rough character of the stonework made trowelling of little value, and there was not sufficient headroom to permit the use of timbering or forms to support a concrete lining while setting; there were also other reasons preventing ordinary methods of working from being adopted. The surface of the stonework was first cleaned by means of a steam jet, and this was at once followed by a jetted stream of concrete, which adhered to the interior surfaces of the tunnel and filled all holes and crevices. Very

small pebbles were used for the coarse aggregate, and sand was used for the fine aggregate. We are also told that no difficulty was found in carrying the concrete several hundred feet from the mixer, and that there was but little wear on the hose, probably because the wet cement acted as a lubricant. The method is worthy of note, and it is to be remembered that it was also used with success in the open cut of the railway at Newark, New Jersey. The process may well have useful applications in this country, and there appears to be no reason why the use of steam should not prove as valuable as the use of compressed air for the purpose described.

In the other article referred to we have a description of the work of repairing certain brick and stonework sewers at St. Louis by means of the cement gun. This not only improved their structural condition by filling up the open joints with mortar, but it increased their carrying capacity by lessening the friction against the interior surfaces. The loose mortar was picked and scraped out of the joints as a preliminary, and it is suggested that where sewers are coated with growths they should be cleaned with a sand blast before applying the cement. Where the inverts are defective it is well to rebuild them with suitable material, but the sides and roof can be coated with cement by means of the cement gun, and at St. Louis, where the carrying capacity of the sewer was evidently a matter of great importance, the cement so applied was trowelled to a polished surface. It is estimated that the finished cement-gun surface will justify a coefficient of 0·015 in Kutter's formula, while trowelling reduces this to 0·013. The value of this method when applied to the repairing of old brick sewers is great. It should increase the life of such sewers indefinitely, for it is clear that in the majority of cases the deterioration is confined to the brick joints which are eroded by the flow of the sewage, and possibly to erosion of the invert.

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Stratford-on-Avon Appointment.

The vacant borough surveyorship of Stratford-on-Avon led recently to one of those typical discussions at the town council which, unfortunately, do not tend to enhance the reputation of municipal administrators. The procedure with respect to the appointment was itself, to say the least, unusual. A Selection Committee submitted a report that they had advertised for eligible candidates, at a commencing salary of £275 a year, and the chairman of the committee asked the town council to confirm the minutes. This was a challenge to an all-round debate upon an issue with respect to which the Selection Committee had already committed themselves, and human nature being as it is it is not surprising that the challenge was accepted with alacrity and expansiveness. It was stated by one speaker in the course of the discussion that the subject had been before the town council previously, and that they in their turn had delegated authority to the Selection Committee. If this was so, it would appear to have been quite unnecessary for the Selection Committee to have done more than report to the town council, and there the matter must have ended so far as that phase of it was concerned. As it was they invited a general discussion, with the result that amendments were proposed calling for the modification of the terms of the appointment after the advertisement for this had been published and some two hundred applications for the post received. Some of the town councillors let themselves go in the old familiar style. Their chief aim was, of course, cheapness, and they seemed indifferent to the means by which this was to be obtained. One gentleman who proposed that the salary should be reduced to £200, confessed it might be argued that by paying a low salary they would not retain a man for many years. This, he should say, would be an advantage to them, "as by not doing so they would be getting the latest science and experience." Consistency did not appear to be a strong quality with this speaker, for he proceeded to argue that what was needed at Stratford-on-Avon immediately was the scientific and experienced management of the various municipal undertakings. Considering all the circumstances, the most pointed remark of the discussion appears to us to have fallen from the councillor who affirmed that it was "ridiculous to bring in such amendments when all the applications for the post had been received." Happily the town council saw the absurdity of the position, though they were none the less to blame for the looseness of procedure which gave rise to the discussion.

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Local Government in 1915.

Among the many difficulties which beset the path of the conscientious municipal officer, not the least is that of keeping himself acquainted with the various changes that are made year by year in the law which it is his duty to administer. These changes are effected in several ways. Some are statutory, and public attention is generally drawn to them during the discussions attendant upon their passage into law. Others, on the contrary, are brought about either by orders of the Local Government Board or other Government Department, or by decisions of the courts. These are not so easy to follow, and even the most vigilant official will inevitably fail if he tries to keep himself *au fait* with all of them by his own unaided efforts. But in these days any effort of this kind is very largely unnecessary, because of the annual volume of "Local Government,"* edited by Mr. Alexander Macmorran, K.C., and Mr. K. M. Macmorran. The volume for 1914-15—the sixth of the series—is now before us. Like its predecessors, it is arranged in encyclopædic form, the section devoted to each topic being divided into five parts, in which are respectively set forth the statute law of the year, Orders of the Local Government Board, forms, a digest of cases, and any appropriate decisions of the Local Government Board. The present volume covers the period from September 1, 1914, to September 1, 1915, and, as might have been expected, certain new titles, relating to subjects arising out of the war, have been included for the first time—namely, Housing of Soldiers, War Allowances and Pensions, and War Refugees. For municipal engineers, however, the chief value of the book lies in the full and accurate information it contains in regard to those subjects which constitute their special domain. To take an example at random, under the heading "Sewers, Drains and Sewage Disposal" will be found the Final Report of the Royal Commission, together with a note of several articles from the "Justice of the Peace" on cognate subjects. This is followed by a digest of four cases decided by the courts during the year, and two rulings given by the Local Government Board. The value of a complete review of the whole field of local government on these comprehensive lines cannot well be overestimated; and in our opinion the volume is one which should be available in the office of every municipal engineer, inasmuch as the knowledge gained from its use will almost certainly prove the means of saving its cost many times over during the year.

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Municipal Officers and War Charities.

An inquiry that has been addressed by the National Association of Local Government Officers to the affiliated associations has revealed the fact that a magnificent response has been made by municipal officers throughout the country to the various appeals on

* London: Butterworth & Co. and Shaw & Sons. Price 22s. 6d.

behalf of war charities. Exact figures are not obtainable, but some idea of what has been accomplished may be gathered from the fact that during the first six months of the war no less a sum than £45,000 was contributed through those local branches about half the total number from which returns have been received. The response which has been made to the appeals for service in the Forces of the Crown, too, is most creditable, over 8,000 members of the association having answered the call. In these circumstances it is only natural that the Management Committee are now proposing to establish a special fund, to be placed under the control of the Benevolent and Orphan Fund for the relief of local government officers and their dependents who may fall upon evil times as a consequence of the war. A rousing appeal has been issued, and it should meet with a rousing and overwhelming response. To repeat the fine words quoted by Mr. Darricotte, the chairman, in commending the proposal to the Management Committee: "O laurel and bay upon the mound or the monument! You are not enough. With silver and gold as well as with proud and tender utterances we must bind up the wounds at home which the death of the bread-winner has brought." The scheme is to be on a national basis, and aims at the establishment of a fund to be used for the benefit of local government officers who are serving as soldiers, sailors, or nurses, or in other capacities in the defence of the realm, and of their dependents in case of death, disablement, or exceptional cases of need arising through the war. It is confidently expected that the response will more than justify the action taken by the committee.

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The Quantity Surveyor. The special function of the quantity surveyor in British architectural practice is so well defined, and its utility is so well recognised, that it is rather surprising to learn from a recent issue of the *Contract Record* of Toronto that the term "quantity surveyor" is a new one in Canada. The arrival at Winnipeg of Mr. Hugh Watkins, the well-known London quantity surveyor, who is acting professionally in connection with the erection of the new Parliament Buildings, is apparently so much of a novelty as to merit special comment. The present practice in Canada, even in the case of buildings of first-class importance, is for each contractor who intends to submit a tender to prepare his own quantities from the drawings and specifications received from the architect. The absurdity of duplicating work in this way, and the greatly increased chance of error arising from the impossibility of a contractor's estimating clerk exercising the care and skill of a professional surveyor are manifest; and Mr. Watkins believes that in the near future the British practice will become general throughout the Dominion. Commenting generally on the subject, our contemporary points out that under the old system, if twenty contractors tender for a given work, nineteen useless bills of quantities are prepared, all of which have to be paid for by someone in the long run in the form of increased establishment charges in the contractor's business. Moreover, a full bill of quantities prepared by an independent surveyor has a further advantage for all parties, in that it forms a reliable basis upon which extras and deductions can be calculated.

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Reduced Lighting and Reduced Payment. It appears from recent correspondence in our pages that considerable interest is being taken at the present time in the question of the allowances that are being made by various gas and electric lighting companies to those local authorities who are compelled to reduce their street lighting. Many ratepayers appear to expect a reduction in the cost of lighting directly proportional to the number of lamps thrown out of use, but, in view of the arrangements usually made with regard to the maintenance of standards, any such expectation is evidently fallacious. The actual reduction in any given case must depend to a very large extent upon the precise terms of the contracts that were in operation before the restrictions due to the war were imposed. Mr. Bernard J. Wormleighton, the surveyor to the Loftus Urban District Council, has collected and tabulated statistics regarding the arrangements that have been made in various districts, and we are able to publish these this week for the information of our readers. One thing is clear—namely, that the standards that are temporarily thrown out of use must be maintained—and that at the cost of the local authority. This involves expenditure that is for the time entirely unproductive, and we observe with interest that in one case an application was made to the Treasury for a grant in aid—but without success. The tabulated statistics are of great interest, and Mr. Wormleighton is deserving of thanks for making them generally available.

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The Crystal Palace School. Among the results of the acquisition of the Crystal Palace by trustees on behalf of the public must be included the necessity for some fundamental changes in the relations between the famous Crystal Palace Engineering School and the trustees. The School has pursued its honourable career for forty-two years, and during the whole of this time it has exercised a great and beneficent influence in the matter of systematic engineering education. It is very satisfactory to learn, therefore, that it is to be continued under the personal direction and responsibility of Mr. J. W. Wilson. This gratifying announcement was made by Mr. H. C. Adams, M.INST.C.E., recently, in the course of the address which he delivered before the Old Students' Society, when he also pointed to the fact that considerably more than two thousand students have passed through the school, as showing how great an influence has been exercised by Mr. J. W. Wilson, Mr. Maurice Wilson, and their father before them. The value of such an institution, with its long and honourable traditions, can hardly be over-estimated, and it is indeed good news that there is no intention of bringing its work to an abrupt conclusion, whatever may be the ultimate destiny of the Crystal Palace itself. It is earnestly to be hoped not only that the school may enjoy an even more prosperous career than hitherto, but also that its valuable and pleasant adjunct, the Old Students' Society, may take on a new lease of life.

Institution of Civil Engineers.—"Electrical Railways," by Mr. H. Metcalf Hobart, M.INST.C.E., was the title of the twenty third "James Forrest" lecture delivered on the 14th inst. at the Institution of Civil Engineers. The president, Mr. Alexander Ross, in opening the proceedings, said that, unfortunately, the lecturer had found it impossible to leave America to deliver the lecture personally, and in these circumstances he had asked his friend Mr. Aspinall to deliver it for him. Mr. Aspinall's consent to this request had been greatly appreciated by Mr. Hobart, as the president was sure it would be also by the members. It was quite unnecessary to introduce Mr. Aspinall. Mr. James Forrest, in whose honour the lectures were founded, had now entered upon his ninety-first year. Mr. Forrest sent a message of respect to the council and of continuing affection for and interest in the institution, in reply to which the council had had the pleasure of expressing their compliments and best wishes. Mr. Forrest's association with the institution had extended over a period of nearly seventy-three years, and the members sincerely hoped that Mr. Forrest might live to read many more lectures delivered in his honour.

Disposal of Suspended Matter in Sewage.*

By RUDOLPH HERING, D.SC.

Sewage is the dirty waste water rejected by a community and serving as a carrier of light solid matter in suspension. It contains, roughly, 1 part of organic matter and 1 part of mineral matter carried by between 1,000 and 5,000 parts of water, this difference indicating the variation in different cities. The organic matter, which alone concerns the question of health and nuisance, differs materially in quality. Some of it is unstable, breaks down quickly and may putrefy within a day, such as certain animal and vegetable liquids; and some is stable and decomposes very slowly, such as hair, wood fibre, epidermis, cartilage and the like.

The unstable matter causes all the nuisance arising from sewage, as it has but a slight resistance to decomposition. It first absorbs oxygen with avidity to form more stable compounds; these have no offensive odour of themselves, nor do they produce gases with foul odours. When the conditions have become such that oxygen for absorption is no longer available in the medium holding the unstable matter, other chemical processes become active, producing chiefly hydrogen compounds. Among the latter we have those which produce foul smelling gases and others which do not.

The dangers to health lie in the transportation to other points of pathogenic bacteria contained in the fresh sewage from sick persons and in the subsequent possibility of their once more getting into the bodies of human beings and higher animals. Bacteria not only adhere to particles of solid matter, but, unless disturbed, remain in any liquid carrying them. It is possible that solid particles of sewage may be stranded in sewers, be held back and finally be blown away by an air current, enter the atmosphere and thus, by contact, cause a new infection. It is also possible that liquids may splash and throw bacteria into the air. In both cases the danger of transmitting disease is extremely small if the sewers have smooth interior surfaces, no opportunities for eddies to form, and good grades to cause a rapid velocity from the sewage receptacles to the outfall. These conditions have been advocated for many years and are the same which will also prevent nuisances.

SANITARY COLLECTION AND DELIVERY OF SEWAGE.

Our wash and bath rooms, toilets, kitchens, laundries, &c., are now supplied with fixtures in such a manner that offensiveness can be entirely excluded. This is done simply by giving them forms and surfaces upon which the dirty water can flow away quickly, no solid particles remain on the surfaces, and a final flushing with clean water will restore the receptacles to their condition before use.

The pipes carrying into the sewers the sewage thus generated should likewise carry it away quickly and completely. The necessary means for accomplishing this are: first, smooth and evenly curved and jointed pipes, and second, good currents of air circulation. The former prevents the catching, retention and consequent putrefaction of solid particles, the latter tends to clean up the exposed surfaces which are otherwise usually covered with slimy growths. This air circulation is automatically established by providing openings to the sewer from the street surfaces, and openings to the house pipes above the roofs of buildings. The air currents are produced by differences of temperature within the sewers, on the street surfaces and above the roofs of buildings, and also by sudden discharges of large quantities of water down the house pipes. It will readily be seen that the currents cannot always be in the same direction. When the outside air is colder, the current must be upwards, and vice versa. The reversal of air flow through the house pipes is not objectionable if the sewage is not putrescent, no foul deposits are in the pipes, and the ventilation is free and ample.

It was formerly strongly opposed, particularly in England, to have street sewer air pass up through the house pipes to the roof. It was feared that street sewer air might enter rooms through imperfect pipes or through the fixtures if their traps were not in order. This opposition is still frequently maintained. On the European Continent and in many American cities, the ventilation of street sewers through house pipes has, however, been found very advantageous, and the practice is growing. The house pipes are kept much cleaner, the slimy coating is largely removed and the escaping air above the roofs is less odorous than when the house pipes are trapped at the bottom against the street sewer. A careful examination made in this country proved that the escaping air from house pipes contains practically no disease germs or other bacteria, and has no offensive odour if the ventilation is good.

After the house sewage enters the street sewers it should be kept flowing without any interruption. This result is readily gotten if the sewers are properly designed and built. The surfaces should be smooth. Vitrified clay pipes, used for small sewers more than any other kind in this country, have the smoothest surfaces. Brick sewers furnish a rough surface even if the joints are carefully made and the bricks are of the best. With good flushing and brushing down at proper intervals they may, however, be kept in a condition so as to entirely prevent offensive odours from the suspended sewage matter therein and disease germs from being retained in a virile condition.

Flushing is another important requirement to prevent offensive odours from the suspended matters in sewage. Above ground, within our houses and on our bodies, we use ample amounts of water for cleansing purposes. Below ground in sewers, ample flushing is equally and even more necessary, due to the relatively great concentration of unstable decomposing suspended matter. Unfortunately, in our country the flushing of sewers has not been given as much attention as is desirable. In almost all European countries, both small and large sewers are flushed frequently, varying from several times a week to once in one or two months. The results of this frequent flushing are very satisfactory, and the money is willingly appropriated.

In our country, particularly in smaller cities, we have extensively introduced automatic flush tanks at the head of all pipe sewers. While these tanks keep the upper ends of the sewers clean and free from deposited suspended matter in a very satisfactory manner, they do not keep the larger sewers lower down the line free from deposits and odours. In this respect our sewer systems could be greatly improved and the odours therefrom materially diminished by introducing flushing arrangements.

When collecting sewers are very long and the distance to the outfall is great, which fact is generally associated with flat grades and slow velocities, we have almost always some putrefaction and offensive odours arising near the lower end. During the long run the oxygen has become exhausted and hydrogen compounds, notably sulphuretted hydrogen, are developed. This condition may be improved by emphasising several remedies above mentioned. Still another expedient is practicable, by replenishing, through artificial aëration, the dissolved air, from which the oxygen has been exhausted and putrefaction has been initiated. Experiments have been made recently, both in England and in America, to accomplish this purpose, and have resulted in more or less success. Where it is possible to force air into a sewage pumping main, under a pressure of at least one atmosphere, good results have been obtained. The air is distributed throughout the water mass, evidenced by the fact that when the pressure is released the excessive air causes a sewage of milk-like appearance from which the air bubbles soon disappear. If sewage bacteria are present in sufficient quantities, an accelerated oxidation of the dissolved organic matter takes place, and the distance of flow before putrefaction begins is lengthened.

Distributing air into the sewage within the flowing section under ordinary pressures seems as yet to have given only moderately good results.

There is still another method available by which sewage oxidation can be facilitated and putrefaction retarded, should the sewage have to flow a long distance to works for treatment. Incidentally, the expense of the final treatment would also be reduced thereby.

When we consider that but very little of the organic matter which is discharged into sewers at

* Paper read at the recent International Engineering Congress at San Francisco.

the house is dissolved, and that about one-half of it is dissolved when the sewage reaches the outfall of an average city, and since that dissolved matter will take oxygen from the water more quickly than the suspended matter, we must conclude that a removal of the suspended matter by fine screening higher up the sewer, before much is dissolved, should be of benefit. Fine screens near the beginning of the main sewers might, for instance, not only prevent foul odours from the sewage near the lower districts, but prevent also the necessity and expense of works for oxidising the amount of dissolved organic matter which is thus eliminated. Whether or not this expedient will be economical must be determined in each case.

The means for removing suspended matter from sewage are settling basins and fine screens. Settling basins require space in which the flowing sewage can be brought to almost a standstill, and give sufficient time for the suspended matter to drop to the bottom of the basin. Unless this matter reaches a second basin for separate decomposition (see below under "Imhoff Tank"), it must be frequently removed, which in the upper parts of a city's sewerage system would generally be objectionable. The superiority of settling basins over screens lies chiefly in facilitating the deposit of the finer and water-saturated parts of the organic matter, which screens generally allow to pass on, and which is a condition in the lower parts of a city's system. The particles of suspended matter have their largest size near the sewage origin, and more particles may, therefore, be caught by a screen before a run in the sewer has begun to break them up. Most of this unbroken matter is lighter than water. It first floats and settles, if at all, after it is thoroughly water-logged. Therefore it would appear that fine screens can be more effective in removing suspended matter near where main sewers begin than where they discharge, and that settling basins can be more effective near the latter points.

The above discussion has covered the general principles concerning suspended matter which should be considered when collecting sewage from an inhabited district, if a complete and rapid delivery to the outfall is to be secured under conditions which are both economical and non-odorous. We have now to mention the general principles which must be considered when finally disposing of the sewage.

SANITARY DISPOSAL OF SEWAGE.

Greater nuisances have been caused by improper sewage disposal than in the collecting system, and yet the ways of avoiding them do not differ much in expense or attention.

It was stated at the outset that we must place the sewage under such conditions that its decomposition will be facilitated by contact with oxygen, and in the absence of oxygen, by such combinations of hydrogen as will produce no offensive odours.

All processes of sewage treatment and disposal, if they are to be satisfactory, permanent and economical, should require, first, a separation from each other of the floating matter, of the settling matter and of the liquids.

As these three parts of the sewage are materially different, one being solid and light, one solid and heavy, and one liquid, the methods of economical treatment, in order to make them inoffensive, will also be different in nearly all cases, and therefore a separation is generally to be recommended. As yet it is not always made, and at some places it may not yet be of sufficient importance to justify the additional expenditure. The drift of opinion, however, is clearly in the direction of separation, and we should endeavour to design our works accordingly.

The floating matter can be retained with little trouble and expense, either by screens or in settling tanks. Being often offensive, its best final disposition is usually by fire or by burial.

The settling matter, which forms the so-called sludge, is that part of the sewage which has always given the greatest amount of trouble. It has constituted the greatest nuisance, and, until within only a few years ago, has successfully defied a treatment which would allow of its inoffensive disposal.

The bulk of the sludge does not normally decompose by oxidation. Its exposure to the atmosphere edges like a thin film to oxidise at the surface, but the exposure permits it to take up many species of bacteria, some of which cause offensive putrefactions. Many ways and means have been tried for the last fifty years, both in England and Germany, to get inoffensive sludge decomposition. A solution was at last found in an expedient which allows the sludge to decompose under water with the exclusion, practically, of all fresh sewage and air.

The first step towards getting this result was taken by Dr. W. O. Travis, of Hampton, England, who devised a two-storey tank, the upper division serving as a settling tank with a slot at the lower edge of an inclined bottom, through which the settling suspended matter passed into the lower division to accumulate and decompose. The in-and-out flows of the two tanks were so proportioned that from three-fifths to four-fifths of the sewage passed through the upper division and one-fifth to two-fifths through the lower one. The largest Travis tank is in Norwich, England. So far as an inoffensive sludge decomposition is concerned, this Travis tank is not a success.

The same two-storey tank was later built in the Emscher district of Germany, by Dr. Imhoff, with at least one important change. No sewage whatever was allowed to pass through the lower tank, thus preventing any part of the sludge from having a continuous contact with fresh sewage and air. Also other advantageous changes were made in this new tank.

The decomposition of the sludge takes place in the lower division and in the absence of dissolved oxygen, but the novel condition is that it continues in the absence also of sulphur bacteria producing sulphuretted hydrogen, and in the presence of bacteria producing substantially only methane and carbon dioxide gases, both of which have no offensive odour. The conditions in the tank gradually become adjusted to conditions favouring the life of substantially only those two classes of bacteria and causing practically all of the others to become inactive.

Quite a varied experience has already been gained with this Imhoff method of disposing of the settling suspended matter of sewage. It has been applied to dilute and strong sewages, to domestic and different trade sewages, and it has so far been found satisfactory in all cases where the conditions for the required special bacterial life were favourable.

We are now facing suggestions for some further variations and improvements of the method. Both in Germany and in the United States thorough investigations of such suggestions have been and are still being made.

It is naturally found that the details of the process may differ with the character of the sewage. The same design and the proportions of its parts may vary under different conditions. The topography of the site alone may determine quite different designs. For instance, we may find in one locality a deep double-deck Imhoff tank to be preferable, while in another two shallow single-deck tanks side by side may be more economical.

The first has the advantage of an automatic sludge separation. Its greater depth has the further advantage of placing the gases of decomposition under greater pressure, which, when the sludge is finally withdrawn and discharged on the surface of the ground, causes the gases to expand and to make the sludge more porous, and therefore more readily drained and dried than where the gases form under shallower depths. The double-deck tank has, however, the disadvantage of greater depth of excavation, perhaps in rock or in wet soil, and also the necessity of getting the right proportion of capacity between upper and lower tanks. If the proportion does not approximately correspond to that of the suspended liquid matter, the efficiency and economical results may not be quite satisfactory. The shallower single-deck tanks have been studied in Berlin and in the United States, particularly by Mr. E. J. Fort, chief engineer, Bureau of Sewers, Borough of Brooklyn. It has been found that the suspended matter is decomposed in the same inoffensive manner as in the deep tanks. The gases of decomposition are also chiefly methane and carbon dioxide, and after final withdrawal, the sludge has also no offensive odour. There is, further, the advantage of complete independence of the two tanks, so that any irregularities in the sludge tank can never have a detrimental influence upon the sewage discharging in the settling tank, and the further advantage that extensions can be more readily made and that an inspection of every part is easier than in the double-deck tank. On the other hand, the disadvantages are that the shallower depth causes the sludge to be less porous and less easily drainable and that it must be pumped or

otherwise specially conveyed from the gutter in the settling tank to the adjoining sludge tank. The separate sludge tanks can be built as single units and can be intermittently filled, or they can be built as a series of tanks continuously operated.

Where separate sludge tanks have been continuously exposed to the air, as in Baltimore and Worchester, inoffensive sludge, as coming from the Imhoff tanks, has not been obtained. The reason appears to be the long exposure of the sludge to the air. In the experiment station of the City of Brooklyn these tanks have been kept covered and the atmospheric air has been substantially excluded. The result has been a sludge as completely inoffensive as that obtained from the Imhoff tanks. It therefore seems desirable to cover such separate sludge tanks, to prevent the free excess of bacteria from the air, and the space under the cover should be filled with the resulting gases of decomposition rising from the sludge. But these gases, when excessive, must be allowed naturally to escape through proper sized openings, and the free inflow of atmospheric air can also be readily prevented.

The preference between the two methods, having the two tanks over or beside each other, may usually be decided on the relative economy of construction and operation, and on the desired quality of the sludge.

In the process of ripening the sludge has a greyish colour. When ripe it has become black, and has a peculiar tar-like, though not disagreeable, odour. It has also lost its original slimy and sticky consistency and has become porous and friable, allowing its water, which is clear, odourless and quite inoffensive, at once to be discharged into streams. The sludge of the shallower tanks is less porous and less easily and quickly drained.

The sludge generally reacts alkaline. Berlin reports that when left in the tanks too long it may again change to a greyish colour, having a distinct acid reaction and offensive odour, and it no longer drains easily. How this change is brought about is not reported, and it has not been noticed at some of the stations in the United States.

In order that the sludge may decompose satisfactorily and quickly, it must not be acid. The acidity can be generally produced, if not from manufacturing waste, from an excessive vegetable diet of a community. When it appears and interferes with the normal decomposition, the sludge should be brought into intimate contact with a moderate amount of fresh sewage, which is usually alkaline, although the amount of such sewage should not be enough to disturb the required bacterial flora already established in the sludge. It is generally better to add some clean hard water or some alkaline solutions.

Perhaps nowhere else than at the Berlin Experiment Station has the desirability of getting a good alkaline sludge been better demonstrated. It can commonly be obtained by a frequent stirring, so that fresh parts will be frequently exposed to bacterial action and the toxines removed. The stirring is best done by mechanical agitators. They should be used daily or more or less often as may be found best, according to the varying character of the newly deposited suspended matter. Comparative experiments with mechanical agitators and with compressed air bubbles forced in at the bottom of the sludge and rising through it have so far indicated a greater efficiency for the former.

As to the character of sludge withdrawals, experiments have indicated that the best results follow when the withdrawals are regular, frequent and in small amounts at a time.

Where sludge is spread upon beds for drying, the climate must be sufficiently temperate to prevent its long remaining frozen. Where the drying beds cannot be covered to moderate the winter temperature, it is better to increase the size of the sludge tanks, so that winter storage can be provided in them. This excessive storage does not so far seem to have been objectionable in this country. To keep the sludge in a good alkaline condition it is, however, well to agitate the older as well as the fresher sludge.

The usual variations in the composition and temperature of the sewage necessarily produce irregularities in the behaviour of the suspended matter; much of it may not readily settle into the sludge tank, or the lighter materials when released may rise up from it. Occasionally, therefore, we see excessive frothing or scum formation. When these amounts become quite large they require radical means for treatment. Small amounts can be scooped up at the surface and burned or buried. Large amounts require other methods of removal.

As a permanent practice it is not economical nor very efficient to break up the scum by hand with poles or with a stream of water, which causes much of it again to settle into the sludge tank. Agitation by mechanical means has been found more useful to settle the frothing and the scum.

Experience has gradually indicated the extent of area which should be provided in the chimneys through which the light particles of suspended matter rise from the sludge tank to the surface. If they are made too small, they tend to cause the scum to rise up high and to flow over. If they are too large, they may, by a long exposure to the air, invite development of putrefactive bacteria, and therefore the formation of a nuisance.

When much frothing is found on the surface of the tank, experiments have indicated that this objectionable condition may be removed also by draining or pumping out the sewage as far down into the sludge tank as practicable, and by refilling the space with clean water from the municipal supply, especially if this is hard water and contains carbonate of lime. The frothing may also be reduced by adding to the sewage slight quantities of lime or soda before it enters the tank, especially if the alkalinity of the sewage is very low.

Cases are now multiplying where some injury may be done both to the process of sludge decomposition as well as to the otherwise odourless sewage treatment by the admission to the sewers of gasoline, due to its growing use for automobiles, &c. This admission not only gives an objectionable odour at the sewage treatment works, not distinguished by most people from the odour of sewage, but it also reduces, and this is more important, the rate of bacterial activity in the sewage and sludge, and therefore the desired rapid decomposition. Legal means may keep the injury from becoming serious.

The automatic sludge decomposition in separate tanks, as just described, should not entirely rule out the old method of precipitating the suspended matter by an added coagulating material, such as lime and the sulphates of alumina and iron, which method has been used for over 50 years. The precipitating processes are not always excessively expensive, and in some cases may actually be most economical in the removal of suspended matter. This may be particularly the case when only a clarification of the sewage is required and where plain settling, such as takes place in the upper chamber of the Imhoff tanks, is insufficient, and also where such clarified sewage can be turned, without objection, into a sufficiently large water course.

There has recently been brought into more or less prominence the method of hastening the digestion of sludge by an artificial aëration, or, as it has now been called, by "activating" the sludge. Air is forced into sludge from the bottom of the tank in which it is stored, and thereby agitates or activates the sludge, so that both an inoffensive condition and an accelerated aërobic decomposition has been maintained. Experiments are being conducted in several of our cities, and final results as to economical results when compared with other methods are not yet available.

Mr. H. W. Clark, Chief Chemist, Massachusetts State Department of Health and Director of the Lawrence Experiment Station, who has been continuing the classical work of the Massachusetts State Department of Health, begun about 1889, has recently again experimented on the treatment of sewage sludge. He states in a letter that since 1912 he initiated and developed a process of purifying sewage by aëration for the accumulation of "growths" in tanks containing layers of slate or other material placed in a nearly horizontal position, one or two inches apart. Air currents aid also in circulating the sewage between the slates, and, in contact with the "growths," purify it in five hours. The process is said to have collected for removal from the Lawrence sewage 80 per cent of the total suspended matter.

Mr. Clark further says that this aëration was viewed at Lawrence by Dr. Gilbert J. Fowler, of Manchester, in 1912, and was further investigated by him and other English workers, and that from it the process of "activated" sludge, a name given by Dr. Fowler, was developed.

Mr. Clark has also investigated sludge treatment in deep tanks, and reaches the conclusion that the successful production of compact, inoffensive sludge depends upon the character of the sewage which produces it and varies with slight differences in

the chemical reactions within the tanks as well as in the methods of operating them. A slight agitation of the currents of air, water or sewage, or an increased alkalinity by the addition of lime, &c., gives for some sludges satisfactory results that cannot otherwise be obtained.

Mr. E. J. Fort, of Brooklyn, says that the results of his investigations seem to indicate so far that it is possible to purify sewage by forced aëration to any degree desired, but also that, because of the excessive expense, it is generally impracticable. He has not yet completed his experiments with "activated sludge."

Mr. T. Chalkley Hatton, Chief Engineer of the Sewerage Commission of Milwaukee, is also experimenting with "activated" sludge, but, as with other experimenters, has not yet arrived at final conclusions. He is using Mr. Clark's suggested slate layers with enforced aëration, and finds that after six hours a well nitrified effluent is obtained, as may be done in any properly operated contact bed with forced aëration, and in much less time in ordinary sprinkling filters. The sludge settles out in from 10 to 20 minutes and leaves a non-putrescible liquid. The sludge is well granulated and drains within a few hours to 50 per cent of moisture content.

The U.S. Public Health Service, in Washington, and the Baltimore Sewerage Commission have also recently begun to make tests on "activated" sludge and sewage aëration. The *Engineering Record* of March 6, 1915, in an article by L. C. Frank, Sanitary Engineer, U.S. Public Health Service, gives a review of the English previous experiments on that subject, as a preliminary to the Baltimore tests. In 1912 Dr. Fowler, and in 1913 Mr. Ardern, experimented on sewage aëration at Manchester, but similar experiments were first made in the United States and in Germany. These gentlemen found that well aërated or "activated" sewage sludge was capable of causing a well nitrified effluent by bringing such sludge in intimate contact and mixture with raw sewage for from four to six hours, when the temperature was above 10 deg. Cent., and best at 20 deg. Cent. The process is essentially a biological one, in which sludge and liquid, as has been known for many years. It is proposed at Baltimore to experiment in a tank through which sewage flows continually, and to use an Imhoff tank for the purpose.

It will be interesting in due time to learn of the results obtained at these several experiment stations. There does not seem to be a question any longer that inoffensive decomposition of sewage can be secured by sufficient aëration—a fact that also has been known for a long time. Agreement, however, does not yet exist on the most effective and economical way of applying and diffusing the air. Whether or not the process of "activating" sewage sludge for an inoffensive disposal will be preferable, by substituting an aërobic for an inoffensive anaërobic decomposition, depends upon the element of comparative cost of both in securing and maintaining the desired unobjectionable conditions.

Price and Quality of Gas.—The Minister of Munitions was asked in the House of Commons if he was aware that the loss in the illuminating and heating power of gas caused by benzol, toluol, and xylol being extracted could be made good by the use of oil and cannel coal; and if he would require gas undertakings where the test was abolished to use artificial substances to maintain the quality of gas or otherwise reduce the price to consumers. Dr. Addison, who replied, stated that consideration of cost and of difficulty in obtaining the materials required restricted the possibility of adopting the processes described, and, as had been previously explained, the deterioration in quality of the gas supplied to consumers was hardly appreciable.

West Riding Surveyors' Association.—Members of the West Riding Surveyors' Association visited Ripon on the 18th inst., and were received in the Board Room of the Poor-law Institution by Mr. John Mason, chairman of the Ripon Rural District Council. Mr. J. H. Halstead (surveyor, Knaresborough Rural District Council, and chairman of the association) thanked Mr. Mason for his reception of the members. During the afternoon a visit was paid to the military sewage works, the new hospitals, power station, and the new roads at the camp. Tea was served at the Lawrence Hotel, after which a hearty vote of thanks was accorded to Mr. J. W. Plewes (surveyor to the Ripon Rural District Council) for making the arrangements, and to Colonel Ellis for permission to visit the camp.

COVENTRY'S HOUSING PROBLEM.

"GROWING IN ACUTENESS."

The housing problem at Coventry was never more acute than at the present time. The decision of the city council to erect 600 artisans' houses just outside the city boundary in the parish of Wyken for munition workers, chiefly those engaged at the Ordnance Works, will (says the *Birmingham Daily Mail*) merely touch the fringe of the question. Many thousands of persons, including a very large number of young women and girls, are in lodgings, and with the constant introduction of female labour into Coventry the problem will remain acute.

The Chamber of Commerce, at the suggestion of the Minister of Munitions, have considered the subject, and have replied that in their opinion the matter of providing temporary accommodation for the workers of Coventry can only be satisfactorily carried out by the city council, but that the Chamber would be glad to co-operate with the council in the work. The Minister of Munitions acknowledged the letter, pointing out that the scheme of housing now in progress would ease the situation as regards the workmen at the Ordnance, but stating that he was impressed by the urgency of finding accommodation for those engaged in factories, and for male and female workers who would shortly be required by firms engaged upon war work.

At the moment various public buildings are being used for temporary accommodation, and in one district commodious huts have been erected for young women. Thousands of young women and girls are engaged upon munitions in Coventry, and many hundreds live outside the city. Others have been brought from a distance, and temporary accommodation is essential. The problem will grow in acuteness with the completion of new factories, and there is no doubt that girls will be installed in the positions of the men who will be released under Lord Derby's scheme.

Private enterprise cannot meet the demand. That has been evident for a long time past. Building costs have gone up by such leaps and bounds that speculative building is not always profitable, and a demand now being considered by the Master Builders' Association from the men in the trade for a considerable rise in wages will not ease the situation. The increased cost in building is from 20 to 25 per cent, and builders do not find that people will pay the increased price per house. If there were 1,500 empty houses in Coventry at the present moment they could all be let. Five or six thousand persons, a considerable portion of whom are married, are now living outside the city.

There seems no possibility of the situation being tided over except by makeshift measures. Matters are abnormal, and abnormal measures are being taken to cope with them.

Road Widths.—Birmingham Public Works Committee considered recently a report from the city engineer, Mr. H. E. Stilgoe, and resolved that all main arterial roads in the future should have a minimum width of 108 ft., and that all existing roads of that description, whenever reconstructed, should be enlarged to that width. Secondary roads, the committee determined, should have a minimum width of 65 ft.

Fire Extinguishers.—Asked in the House of Commons whether the prohibition against certain British-made fire extinguishers would be withdrawn, provided all claims that they were effective in connection with Zeppelin bombs were no longer persisted in, the Home Secretary stated that if all claim to their being effective against Zeppelin bombs or the fire caused by them were abandoned, he did not think the warning issued by the Press Bureau would apply.

Northwich Gas Supply.—The Bill to provide for the transfer of the undertaking of the Northwich Gas Company to the Urban District Council of Northwich has been deposited in the Private Bill Office of the House of Commons for introduction into Parliament next session. The price will be fixed by agreement, or, alternatively, by arbitration. The council also intend to ask Parliament to authorise them to borrow £32,000 for the erection, extension, alteration and improvement of the gasworks, for new mains and improvement of gas mains, and for new meters, stoves and fittings.

Gas and Electricity for Motive Power.

COMPARATIVE COSTS.*

By W. A. TOOKEY, M.I.MECH.E.

The competition that exists between the gas and electric undertakings for the supply of motive power for factories in large cities is particularly keen, and it is therefore important to realise the comparative costs of each upon a truly comparable basis. In the case of an electric motor there are several outstanding advantages when compared with a gas engine; but usually the cheaper operating cost of the gas engine determines that of the two the latter is preferable for purely commercial reasons.

Some idea of the relative working costs may be instanced. The efficiency of the town-gas engine is determined by two main considerations: The compression pressure for which it has been designed by the makers absolutely fixes its minimum appetite for gas in relation to the work it is called upon to do; and the condition in which it is maintained decides how nearly this minimum is approached in daily work. In the early days of gas engines the compression pressure rarely exceeded 50 lb. per square inch. Later examples—say the period 1890-1900—were constructed of such proportions as regards the volume swept by the piston in its travel from one end of the cylinder to the other, compared with the volume of the clearance space, that compression pressures of about 80 lb. were obtained. From 1900 to 1910 compression pressures of 100 lb. were usual, but more recently these have been in the neighbourhood of 120 lb., while some of the latest designs have reached about 150 lb.

In a paper presented by the author two years ago attention was directed to the falling off of thermal efficiency in gas engines with reduction of compression pressure, referring particularly to the maximum possible—that is to say, with engines working under full loads. To indicate the extent of this loss of efficiency, the following figures will suffice:—

Compression pressure, lb. per sq. in.	50	80	100	120	150
Gas consumption in B.Th.U. per i.h.p. hour at highest thermal efficiency	12,700	9,100	8,200	7,600	7,100
Equivalent cub. ft. per i.h.p. hour with gas at 500 B.Th.U. per cub. ft.	25·4	18·2	16·4	15·2	14·2

But, inasmuch as the power represented as i.h.p. includes the loss due to the friction of the engine itself, the above figures have to be corrected before proper comparison with electric motors becomes possible. Engine friction is practically uniform throughout the range of power that can be dealt with by a gas engine as long as the speed of rotation is unaffected, as is, of course, the case when the governor maintains the desired constancy within close limits. Experience has shown that the friction loss is independent of the size of gas engine and of the compression pressure, and may be taken as equivalent to 14 lb. per square inch on working strokes. The indicated mean pressure, however, varies with the compression pressure, so that the mean b.h.p. pressure representing the difference between the two can be averaged as shown below:—

Compression pressure, lb. per sq. in. = P_c.	50	80	100	120	160
I.H.P. mean pressure = P_m	72	90	95	99	103·5
F.H.P. mean pressure = P_c	14	14	14	14	14
B.H.P. mean pressure = P_n at full load	52	76	81	85	89·5
Mechanical efficiency $E_m = \frac{P_n}{P_m}$ at full load	·81	·84	·85	·86	·864

It must be recognised, however, that in practical work a gas engine is not called upon to operate always at full load, but sometimes very considerably less. The following figures will give a good idea of the actual efficiencies reached at various loads, and will indicate the gas consumption thereby entailed on the basis of cubic feet per b.h.p., assuming, as before, that the gas has an average calorific value of 500 B.Th.U. per cubic foot:—

Compression pressure, lb. per sq. in. = P_c	50	80	100	120	160
Full Load.					
E_m	·81	·84	·85	·86	·864
Cub. ft. per b.h.p. hour (500 B.Th.U. gas)	31·5	21·7	19·3	17·65	16·45
¾ Load.					
E_m	·76	·80	·81	·82	·83
Cub. ft. per b.h.p. hour	23·5	22·7	20·2	18·5	17·1
½ Load.					
E_m	·675	·73	·74	·75	·76
Cub. ft. per b.h.p. hour	37·5	24·9	22·2	19·75	18·7
¼ Load.					
E_m	·51	·58	·60	·61	·62
Cub. ft. per b.h.p. hour	50·0	31·5	27·3	25·0	22·9

Probably the majority of gas engines may be considered as working at a mean load equivalent to five-eighths of the maximum, and the table given shows that, according to the age of the engine as indicated by the variation in compression pressure, the gas consumption will vary from about 35 to 18 cub. ft. per b.h.p. hour. If it be assumed that a compression pressure of 100 lb. applies to the larger number of engines that are at present in operation, then, for comparable figures with regard to electric motors, it might be taken that the average engine demands, say, 19 cub. ft. of 500 B.Th.U. gas per b.h.p. hour. Thus, if for purposes of comparison the average price of town gas to power consumers be taken as 20d. per 1,000 cub. ft., the cost of generating 1 b.h.p. hour would be 0·38d.

As regards electric motors, the estimation of the rate of current consumption is a much simpler matter. According to the size, so the efficiency varies, being higher in large machines than in small. Thus, while the former will give out as power 90 per cent of the current applied to the terminals at full load, 88 per cent at three-quarter, 84·5 per cent at half, and 74 per cent at a quarter load, smaller machines would yield, say, 85 per cent at full, 84 per cent at three-quarter, 79 per cent at half, and 70 per cent at quarter load. Taking the mean of these, the following table will show the approximate rate of current consumption of average motors at various outputs per b.h.p. hour:—

	Full	¾	½	¼
Motor efficiency average	·875	·86	·82	·72
Equivalent to units per b.h.p. hour	·852	·868	·91	1·035

Assuming, as in the case of the gas engine, that the normal factory load would approximate to the equivalent of five-eighths of the full-load output, it will be seen from the above table that about ·89 unit would be consumed per b.h.p. hour, and therefore for similar working costs this should be procurable for the same price as 19 cub. ft. of gas, or, on the assumption of cost already made, gas at 20d. per 1,000 cub. ft. would be equivalent to electricity at ·427d. per unit. In other words, electric current at 1d. per unit may be taken as being equivalent to gas at 46d. per 1,000 cub. ft.

Notwithstanding this vast difference in favour of the small gas engine served by town gas over small electric motors, there are many conditions under which the latter would preferably be installed.

As regards the relative first costs, it is difficult to do more than to indicate these approximately, as so much depends upon local circumstances appertaining to the site and the amount of piping, cabling, &c., that may be required. As a very rough guide, the accompanying chart has been prepared, and from this it will be seen that, for true comparisons, the interest upon the additional capital involved in the case of gas engines should be set off in favour of the electric motor. Take a 20-h.p. machine, for example. The chart shows that while a motor fixed would cost about £60, a gas engine of equal output would cost nearly double, and a suction-gas engine and producer about

* Extracts from paper read at a meeting of the Junior Institution of Engineers held on December 20th.

[illegible] times as much. The town-gas engine should therefore be charged with £6 per annum as additional standing charges to cover higher depreciation and interest, while the suction-gas plant should be debited with an additional £15 for the same reason.

This is tantamount to saying that much depends upon the average or mean load that will prevail during the period of work, and whether the amount likely to be saved by the more economical plant will in fact result in an actual saving of money, all things considered. The amount of power required upon more or less rare cases of emergency must also be taken into account, for, while the maximum power of a gas

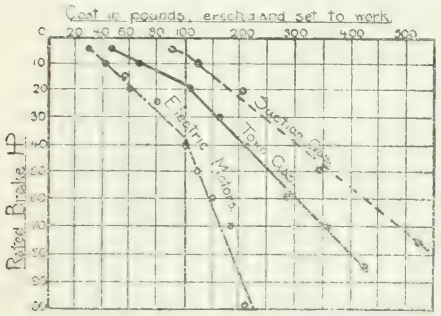


Chart showing Comparative Installation Costs of Town Gas, Suction Gas and Electricity Power Plants.

engine is inelastic, an electric motor can deal with overloads for short or long periods without distress. There are a number of other important considerations to which careful attention has to be given, but to attempt to cover all these in the present paper would limit its scope and prevent discussion of other matters more germane to the subject with which it is particularly concerned. In existing power plants, however, it should be recognised that, as long as a reasonably efficient motor, either gas or electric, is already installed, its commercial value as it stands must enter into all considerations either in respect of its retention or the amount of money that it may realise in the open market.

Coming now to the cost of operation of suction-gas engines and producers, it can be stated that from a large number of plants of this type, operated under every-day working conditions, and including all wastage due to stand-by losses and unutilisable portions of fuel supplied, about 2 lb. of anthracite are required to generate the equivalent of one electrical unit of energy.

On this basis, and referring only to fuel cost, electricity at 1d. per unit would be equivalent to anthracite at 56s. per ton. As a matter of fact, with proper debits for water consumed for steam raising, washing, &c., repairs, and attendance, experience with plants under ordinary conditions as to mean output, &c., indicates that the average cost of generating one unit of electricity with suction gas engines and plants does not fall far short of ·75d. per unit when overhead charges are also taken into account, with anthracite at 34s. per ton. In other words, while the cost of fuel is only about ·375d. per unit, the other expenses usually amount to about as much again. These are, of course, rough figures, but will probably be of some little value for comparative purposes when it is desired to know the relative costs of different forms of power supply for factory purposes.

Whitened Lamp-posts in Hammersmith. As lamp-posts cannot be seen very well at night, Hammersmith Borough Council are having them painted white. Red lights are to be placed on street refuges.

Lack of Houses at Rugby.—In reply to an application from the Rugby Urban Council for a loan for housing purposes, the Local Government Board say they regret they would not be able at the present time to sanction a loan for working-class dwellings unless it were shown that their immediate provision was urgently necessary in connection with war requirements. The council have decided to approach the Local Government Board on the subject again, pointing out that the houses are urgently needed for munition workers.

CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.

The 129th "Certificate Day" of this school was celebrated on the 22nd inst., in the school lecture theatre, the chairman on this occasion being Mr. Percy Griffith, M.INST.C.E., F.G.S., president-elect of the Society of Engineers.

The list of awards having been read by the vice-principal (Mr. Maurice Wilson, ASSOC.M.INST.C.E.), the chairman said that he had been requested to make a few remarks, particularly to the students, before presenting the certificates and other awards. He first referred to the fact that he had himself been a student at the school thirty-three years ago, and was very proud to think that the progress he had since made in the profession was sufficient to induce the principal to invite him to preside on this occasion. He was, he understood, the first old student who had been so honoured, and although he himself had serious doubts whether this honour was deserved, he was bound to accept the principal's decision on the point, and was therefore only too proud to accept the invitation.

Referring to the school, he remarked upon the peculiar associations attaching to the Crystal Palace and the various organisations attached to it. It was at the present time worth while to recall the fact that this magnificent structure was erected in the first instance as a Temple of Peace, and on its inauguration in 1851, the prevailing thought appeared to be that the rapid development of industrial arts and sciences would bring about an absolute cessation of war. The use to which the Palace was now being put was a sad and striking commentary on the fallacy of such ideals; this was, he thought, well illustrated by the use of glass (a true type of fragility) in its construction. Nevertheless, it was also constructed of iron, the type of stability and permanence, and he hoped the future history of the Palace and the School would ultimately prove the stability and permanence of the peaceful arts.

Addressing the students, the chairman reminded them that though their parents, in sending them there, intended them to advance their own prospects, they should realise that they had a nobler purpose to fulfil; they were entering an honourable profession, and it was their duty to maintain the honour of that profession; they also had to maintain the honour of the school, both now and in the future.

This was the least they could do, bearing in mind the training they had received there. The school had always been unique, not only in its associations, but in its methods. These were based upon paternal and personal attention on the part of the principals. In the larger colleges such personal attention was out of the question, but the Crystal Palace School was essentially a school of practical engineering, and the students received constant personal and practical assistance from the principals and the staff.

The chairman then distributed the certificates awarded to the students for their term's work, also the "Wilson" premium awarded to Mr. C. L. L. C. Brock for his paper on "Railway Bridges," read before the Crystal Palace Engineering Society. The medal awarded to the students who, having completed the full course of three years at the school, and having in every case been placed not lower than third in order of merit, was then presented to Mr. M. Kesvan, an Indian student, to whom the chairman addressed a few words of congratulation and advice.

The principal (Mr. J. W. Wilson, M.INST.C.E.) then gave an explanation of the future prospects of the school, arising from the transfer of the Palace to National Trustees. He said that at the moment it seemed probable that at the end of next term the school would be compelled to remove from its old home in the South Tower and find new quarters outside the Palace precincts. He was, however, prepared to face this contingency, and asked for support in carrying on the school under the new conditions.

The Mayor of Wandsworth proposed a vote of thanks to the chairman, which was heartily accorded, and in acknowledging this Mr. Griffith pointed out the desirability of parents sending their boys to the school at an earlier age than was usual, so that by the time they reached military age they would be prepared to take up any of the technical branches of the Service, in which the conditions of modern warfare offered such splendid opportunities.

The Crystal Palace School will commence its 130th term on January 5th.

Comparative Reports of General Practice.—(LXXXIV.)

PAYMENT FOR PUBLIC LIGHTING UNDER RESTRICTED LIGHTING ORDER.

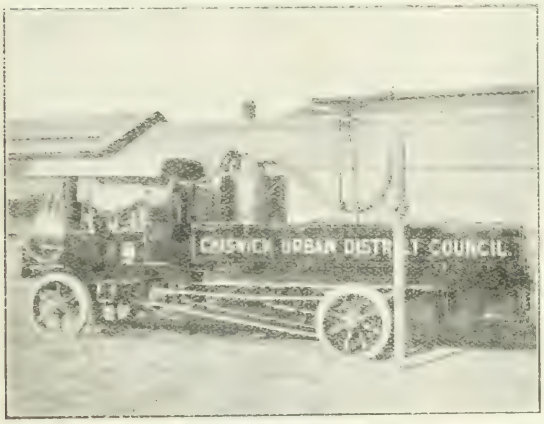
This return, which has been prepared by Mr. BERNARD J. WORMLEIGHTON, F.A.S.I., M.R.SAN.I., surveyor to the Loftus, Yorks, Urban District Council, provides information which will be of special interest to municipal engineers in towns affected by the war-time regulations in regard to public lighting.

Town	Popula-tion	Is Local Authority pro-vided with lighting supply on?	What is lighting medium	Number of public lamps maintained	Number of lamps now lit	If Local authority does not supply its own power, what is basis of pay-ment for public lighting?	What arrangement has been made in your district for payment of those lamps not lit	Have you applied to the Treasury for a grant in aid of payment for lamps not lit?	Remarks
BEDFORD (B.C.)	49,000	Yes	Electricity	1,100	750	——	Only standing charges will be charged to Borough Fund	No	——
CHICHESTER (B.C.)	14,700	Electricity Yes Gas No	Electricity and Gas	750 Gas 52 Electric	5 Gas	Agreed price per unit electricity and per 1,000 cubic feet of gas	Payment will be made for actual consumption only	No	Present expenditure £15 per annum against 1914 normal times. Council maintain their own standards.
CLEETHORPES (U.D.)	21,000	No	Gas	420	Nil	By annual tender per 5,000 hours lit	£150 per annum for maintenance of lamp standards only, i.e., 10 per cent. capital out-lay on standards.	No	Gas Company asked for 50% to cover maintenance and depreciation of lamp standards. Council allowed £150 per annum.
DURHAM CITY	18,000	No	Gas	400	67	£5 0s. 6d. per 5 cubic feet burner per annum, inclusive of mantle mainte-nance, &c.	Excluding upkeep, interest on plant, and average of replacements, gas not burnt is allowed for probably 35 per cent per annum	No, and have no intention of doing so	I should think you are entitled to rebate in respect of current not used, after allowing for upkeep of the system
FEATHERSTONE (U.D.)	15,000	No	Gas	380	80	By average meter readings	Only pay for gas consumed	No	——
GRAVESEND (B.C.)	24,000	Electricity Yes Gas—No	Electricity and Gas	264 Gas 354 Electric	264 Gas 150 Electric	For gas £2 19s. per lamp per annum before the war.	Gas Company have asked for 50 per cent pay-ment for loss, but on about half the lamps only, namely, £12 10s. per quarter.	No	Gas Company have given notice that supply will be 15 3s. per lamp per annum
GREAT YARMOUTH (C.B.)	58,000	Electricity	Gas from company one third, Electri-city two-thirds	About 1,000	None	3s. 4d. per 1,000 gas & 19s. per annum for lighting, cleaning, &c. Capital on post. 10 per cent. discount on gas	To Gas Company the cost of lighting, clean-ing, and capital expenditure. To Electric Lighting Committee, one-third P.O. account towards their interest and sinking fund.	No	——
IPSWICH (C.B.)	70,472	Electricity	Electricity and Gas	1,570 Gas 230 Electricity	None	Electric Lighting Committee charge Public Lighting Committee 1d. per unit.	One-third of public lamps belong to Gas Company and two-thirds to Authority, we pay 5s. per quarter per lamp for lamps not lighted to the Gas Company.	No	The only lighting we are doing is refuge lamps. On these we fix an oil lamp with red sides to keep vehicular traffic on road
LOFTUS (U.D.)	10,000	No	Electricity	144	None	£2 5s. per lamp per annum, including maintenance. 65 B standard C.P. 80 Watts. Let 246 days in each year, half-hour after sunset to midnight, except Sundays. Sundays to 11 p.m.	Agreed to pay Electric Company at rate of £200 per annum for those lights on which lamps are not lit	Yes. No grant will be made	Council has decided to light a few of the lamps as pilot lamps at dangerous corners—after this date
							Based on following figures:— 5 per cent. interest on capital laid idle 1 year's redemption of this capital ÷ 25 years' redemption ½ of electrician's wages ½ of ordinary cost of maintenance per lamp per annum.		
NORWICH (CITY)	130,000	Electricity—Yes	Electricity	——	None	——	Lighting Committee pay Electricity Com-mittee £3,600 per annum to cover capital maintenance and charges on plant involved in street lighting	No	I think Local Authority should not seek towards payment of reasonable charges as above, but think Company should be satisfied with profit at rate of 5 per cent. on capital laid idle
PETERBOROUGH (CITY)	33,574	Electricity Yes Gas No	Electricity and Gas	290 Electric 652 Gas	13 Gas 40 Electric	Fixed price per lamp per annum according to type of lamp used.	No arrangements as to terms have been arrived at	No	The 40 electric lamps which are lit have been fitted with carbon filament lamps 8 to 15 candle-power, shaded on top.
REDCAR (U.D.)	12,000	No	Gas	277	None since April, 1915	We paid last year for lamps only lit to December and from January to April, 1915.	None	No	——
ROCHESTER (CITY)	33,000	No	Gas	650 (about)	37	Contract £5 per lamp per annum to light, extinguish, clean and main-tain Corporation's own lamps and columns.	Lamps not lighted are not charged for except 1s. 4d. per lamp per quarter for maintenance.	No	——
SCARBOROUGH (B.C.)	37,201	No	Gas	1,643	400	Up to 5 million cubic feet 2s. 4·8d. per 1,000. 5 to 10 million cubic feet, 2s. 3·2d.	The Gas Company allow the saving on mantles and globes	No	——
SITTINGBOURNE (U.D.)	9,000	No	Gas	200	None	£3 2s. 6d. per lamp per annum when lighted	Not paid for	No	——
SOUTH SHIELDS (C.B.)	111,000	Electricity Yes Gas—No	Electricity and Gas	662 Electric 2,349 Gas	——	Annual charge per lamp varying according to candle-power.	Arranged to pay standing charges, deleting the following — Gas not consumed Profit on such gas. Mantles, protectors, &c. Labour charges for lighting and main-taining.	No	This arrangement saves Company from actual loss, but Company bear pro-portion of interest and sinking fund charges on mains, lamps standards, &c.
SUNDERLAND (C.B.)	152,931	Electricity Yes Gas No	Electricity and Gas	2,025 Gas 894 Electric	Gas—None 120 Electric from 5 to 9 p.m., 15 from 5 to 11 p.m.	Gas, 4os. per lamp per annum, inclu-sive of maintenance.	None	No	——
YORK (CITY)	83,000	Electricity—Yes Gas—No	Electricity and Gas	1,433 Gas 574 Electric	About one-half of number	Prices per lamp per annum vary from £1 19s. 6d. to £5 13s. 6d., according to candle-power.	Reduction amounts to cost of gas or electricity, cleaning and lighting, together with agreed sum for interest and sinking fund charges.	No	The lamps of the city have never been extinguished at important road junc-tions, and have been latterly increased to about alternate lamps, all, of course, shaded.
TYNEMOUTH (C.B.)	61,403	No	Gas	——	None	Payment made on "average meter" system	Gas not paid for when lamps not lit.	No	——

MOTOR TRACTION AT CHISWICK.

A SPECIAL TYPE OF STEAM WAGON.

The Urban district of Chiswick have recently purchased two of the Yorkshire Commercial Motor Company's 4-ton steam wagons.

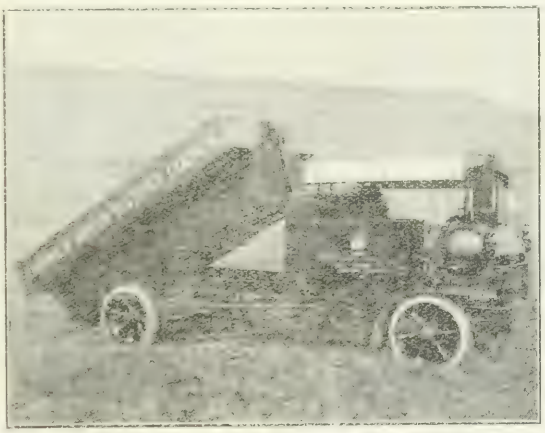


Gully Emptying Apparatus on Chiswick Steam Wagon Fitted with Ordinary Slop Body.

Owing to the extremely flat character of the district, the 35 h.p. type of engine and gearing was adopted as being ample for the needs of the district, but the rear axle was calculated for a 4-ton to 5-ton load.

A somewhat special type of body has been adopted, it being extremely low, the uppermost portion measuring 4 ft. 6 in. from the road level, thus eliminating a great deal of labour in loading.

There is also a very large capacity for wet slop, and a patent vacuum gully emptying apparatus, specially designed by the engineer to the company, in accordance with the requirements of Mr. Edward Willis, the council's engineer, and the adaptation of this to the slop van and materials body entirely eliminates the necessity for the large vacuum tank body.



Slop Body in Tipped Position.

Some such arrangement as the present seems especially useful for small districts, where the gullies would not be sufficient in number to warrant a special machine being kept for the purpose of emptying them, and the apparatus is proving so successful in Chiswick and Bradford that the company have already protected themselves by patenting it.

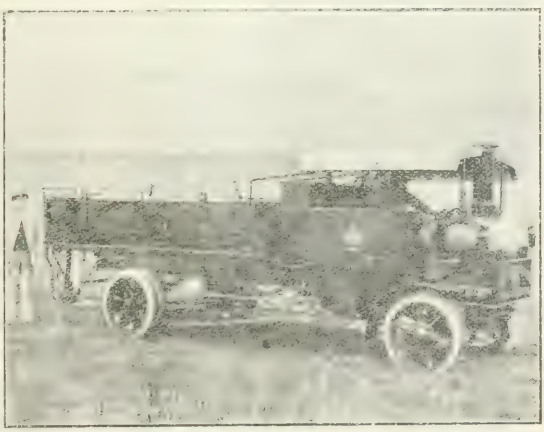
There is also a detachable 850-gallon water-van body, with American pattern sprinklers, and a 9-in. valve for sewer flushing.

The vehicle when loaded normally travels at from 8 to 12 miles per hour, but is quite capable of doubling this speed should the necessity arise.

It was in 1897 that Chiswick first adopted steam tractors, but these were sold as not proving commercially satisfactory, and they eventually found their way to South Africa.

The present engineer, Mr. Willis, advised the council to adopt petrol motors for this purpose in preference to steam, but owing to the majority of the best petrol motor manufacturers being unable to guarantee delivery, and, further, owing to the serious difficulty in obtaining horses, the council decided to purchase the two steam wagons from the Yorkshire Commercial Motor Company, the first of their kind made for this class of municipal work.

The engineer, in his report to the council, also rather favoured horse traction in small districts, but he was of opinion that motor traction should prove economical for road watering and gully emptying, but not for the majority of municipal services in small, compact districts.



Chiswick Steam Wagon Fitted with 850 Gallon Water Body.

Porthcawl New Main Drainage Works.—The new main drainage works of the Porthcawl Urban District Council were formally opened last week. The cost of the scheme was approximately £8,000 and the works were designed and supervised by Mr. Midgely Taylor. The contractors for the sewerage works were Messrs. Tom Wilkinson & Co., Poole.

Road Damage by Studded Wheels of Locomotives. A case in which the Staffordshire County Council were the prosecutors was heard at the Newcastle-under-Lyme Police Court on Tuesday, when Joseph Carter, Betley Common, was fined £3 7s., including advocate's fee, for using a locomotive on the highway, the driving wheels of which were shod with studs. Mr. E. H. Breton, who appeared for the prosecution, said the section of the Highways and Locomotives Amendment Act under which the proceedings were taken provided that the driving wheels should be cylindrical and smooth-soled. A considerable amount of money would have to be spent in repairing the damaged road.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The following books have been chosen in respect of the premium for November:—

By Private B. KNIGHT, of Newport, "Roofs and Bridges," Part I., by Merriman and Jacoby (Chapman & Hall), and

By Mr. J. G. WILKIN, of Downpatrick, "Drainage and Sanitation," by E. H. Blake (Batsford).

Both books have been duly sent and acknowledged by the recipients.

QUESTIONS.

This week answers are invited to the following questions:—

519. Mechanics.—Define the terms "force" and "work done by a force." What are the units of force and work as adopted by engineers in this country? State the relations between the gravitation and absolute units of force and work, and say why the latter units are so desirable for many scientific purposes. ("Student.")

520. Properties of Materials.—Compare the properties of wood and steel as regards the use of these materials for beams. (T. R.)

521. Mechanics.—What fraction of the weight of a body is required to keep it from flying off the earth's surface, at the equator, supposing the equatorial radius of the earth to be 4,000 miles, and that it makes one complete revolution on its axis in a solar day of twenty-four hours? (H. P. H. M.)

522. Laundry Design.—A laundry is required for a temporary boys' hostel accommodating 400 boys. The laundry to be constructed of 4-in. by 2-in., &c., timber, weather-boarded outside and lined with asbestos sheets inside. Provision to be made for drying-room, iron-room, wash-house, engine-room, coals, &c. The laundry to contain washing machine, wringing machine, mangling machine, &c., and an engine to drive machines, with boiler-house. Give plan, elevations and sections of a suitable laundry, with sizes of machines. ("Ajax.")

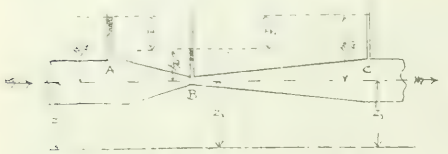
523. Theory of Structures.—Explain Bow's method of lettering a system of forces, and give one or two examples as applied to framed structures.

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

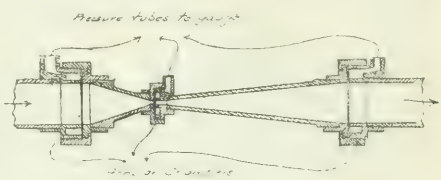
517. Venturi Meter.—Describe, with sketch, the construction of the Venturi meter, and explain the hydraulic principles on which it is based. ("Hydraulics.")

The Venturi meter consists of two conical tubes connected by a short cylindrical portion known as the throat. The general arrangement is shown in



DIAGRAMMATIC SKETCH OF VENTURI METER.

the sketch. The meter is placed horizontally in a line of piping, the two ends being of the diameters equal to that of the piping. All the junctions with the pipe line, and also at the throat, are annular chambers, connected with the pipe by holes bored through its thickness. Pressure tubes are connected to the annular chamber at the throat and to one or both of the chambers at the bases of the caves. These are connected to some form of differential



METER AS CONSTRUCTED.

gauge, or an integrating and recording apparatus, as figured in the catalogues of Messrs. Kent & Co.

If H and H_1 be the differences of pressure head at the throat and large ends A and C respectively,

a area of throat B $\quad \frac{p}{w}$ pressure head at throat

a_1 " pipe at A $\quad \frac{p_1}{w}$ " " " A

a_2 " " C $\quad \frac{p_2}{w}$ " " " C

Q quantity of water flowing in cubic ft. per sec.

v velocity at throat

v_1 " " A

v_2 " " C

Then

$$H = \frac{p_1}{w} - \frac{p}{w}$$

$$H_1 = \frac{p_2}{w} - \frac{p_1}{w}$$

Assuming now Bernoulli's theorem that $\frac{p}{w} + \frac{v^2}{2g} = Z$ constant for all sections of the stream,

$$\therefore \frac{p}{w} + \frac{v^2}{2g} = \frac{p_1}{w} + \frac{v_1^2}{2g} = \frac{p_2}{w} + \frac{v_2^2}{2g}$$

Z being constant in this case.

We have seen that $H = \frac{p_1}{w} - \frac{p}{w}$. from above

$$H = \frac{v^2 - v_1^2}{2g}$$

The velocity $v = \frac{Q}{a}$ and $v_1 = \frac{Q}{a_1}$

$$\therefore 2gH = \frac{Q^2}{a^2} - \frac{Q^2}{a_1^2}$$

$$\therefore Q = \frac{aa_1}{\sqrt{a_1^2 - a^2}} \sqrt{2gH}$$

The discharge is proportional to $\sqrt{H}$, where H is the difference of pressure head between A and the throat. By similar reasoning it can be proved to be proportional to $\sqrt{H_1}$, where H_1 is the difference of pressure head between C and the throat.

In actual practice it is found that, due to eddy motion and friction through the meter, a constant K has to be inserted in the above, so that

$$Q = K \frac{aa_1}{\sqrt{a_1^2 - a^2}} \sqrt{2gH}$$

K varies from 0·9494 to 1·3583 depending upon H.

The object of enlarging the pipe from B to C more slowly than it was diminished from A to B is to reduce eddy motion as much as possible in changing the velocity energy at B to pressure energy at C.

For the details of construction of the integrating apparatus and the recorder, the querist is referred to the catalogue of Messrs. Kent, of High Holborn, and to the paper of Mr. Clemens Herschell to the Canadian Society of Civil Engineers in 1902.

The Surveyor
And Municipal and County Engineer

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518. Strength of Materials.—Explain clearly the meaning of the terms (*a*) stress, (*b*) strain, (*c*) modulus of elasticity. What is the relation between them?

Stress.—When forces are applied to a body, so as to produce, or to tend to produce, an alteration in shape of the body—*i.e.*, elongation, compression, bending, twisting, &c.—there is a resistance or reactionary effect produced on the particles of the material of the body to such force. This resistance is called stress. The "intensity of stress," or "stress," as it is generally called, on any given section of a body is the total force acting normal to the section, divided by the area of such section, or it is the amount of force per unit area. It is generally expressed in lbs. or tons per square inch. Strain.—When force is applied to a body, or, as above defined, the body is placed in a state of stress, so as to produce an alteration in the form or shape of the body, such alteration is called the strain. It is expressed as the elongation or diminution per unit of length, as follows:—

$$\text{Tensile strain} = \frac{\text{Increase of length}}{\text{Original length}}$$

$$\text{Compressive strain} = \frac{\text{Diminution of length}}{\text{Original length}}$$

If a material be subjected to a tensile stress it will be increased in length, such increase being directly proportional to the amount of stress. This rule only holds good to a certain limit, called the limit of elasticity, and up to this point, if the stress be released, the material will go back to its original shape and dimensions. Beyond the limit of elasticity the increase in length of the material is greater than what it is up to this point, for the same increase in stress, and if the stress is released the material will not go back to its original dimensions, but what is called a "permanent set" will take place. Modulus of Elasticity.—As above stated, up to the limit of elasticity, the amount of strain in a material is directly proportional to the stress, such proportions, of course, varying with each material, and therefore the ratio of stress to strain is a constant quantity. This ratio is called the modulus of elasticity, and is expressed as follows:—

$$\text{Modulus of elasticity} = \frac{\text{Stress}}{\text{Strain}}$$

When strain $\left(\frac{\text{Increase in length}}{\text{Original length}}\right)$ equals unity, or, in other words, when a material has been stretched to double its original length, the modulus of elasticity will equal the stress; therefore, the load necessary to stress a material to double its original length equals the modulus of elasticity. In the case of most materials the elastic limit would be reached long before the increase in length would be an amount equal to the original length of the material; therefore the value of the modulus of elasticity is purely an imaginary value. ("Munt.")

The following definitions are taken from Rivington's "Notes on Building Construction," Part IV.: (*a*) Stress—"When a force acts upon a structure or piece of material it produces an alteration of form, or strain, which may be merely temporary, lasting only while the force is applied, or it may be permanent, or may eventually end in rupture. This alteration of form calls out a resistance in the internal structure of the material, which is called the stress upon the body." Thus, if a tie-bar of section a square inches sustains a pull of P lbs., and we consider it cut by an imaginary plane perpendicular to the axis, dividing the bar into two parts, then at this section the one portion exerts a pull on the other portion, which just balances P, and is therefore equal and opposite to it. The average force exerted per square inch of section is—

$$p = \frac{P}{a}$$

and this value p is the mean intensity of tensile stress at this section. (*b*) "Strain is the alteration in the shape of a body produced by a stress." If a tie-bar is of a length l inches, and after the application of a stress it measures $(l + \delta l)$ inches, the strain is $\frac{\delta l}{l}$. The strain is obviously equal numerically to the stretch per unit length. (*c*) Modulus of elasticity—Hook's law states that within the elastic limits the strain produced is proportional to the stress producing it, and modulus of elasticity may be defined as "a number representing the ratio of the intensity of the stress (of any kind) to the intensity of the strain (of the same kind) produced by that stress, as long as the elastic limit is not passed." From the definition, the relation existing between the above terms is—

$$\frac{\text{Intensity of stress}}{\text{Intensity of strain}} = \text{Modulus of elasticity}$$

$$\text{or } \frac{\frac{p}{\delta l}}{\frac{l}{}} = \frac{P l}{a\,\delta l} = E$$

At one time the word "strain" was generally used instead of the word stress, to denote the forces of tension, compression, &c., and it is still so used in many treatises on applied mechanics; but, under the high authority of the late Prof. Rankine, the best writers on the subject use the word "stress" to signify the forces acting upon a body, and the word "strain" to mean the alteration in shape that takes place under the action of those stresses. (J. G. W., *Downpatrick.*)

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

NEXT YEAR'S PRESIDENT.

Mr. John S. Brodie, M.INST.C.E., borough engineer and surveyor of Blackpool, whose nomination as president of the Institution of Municipal and County Engineers for 1916-17 was announced in our issue of last week, commenced his professional career as pupil under the late Mr. John A. Harrison, of Newcastle-on-Tyne, and was engaged by him on the Newcastle and Gateshead water supply, the Scotswood, Newburn and Wylam Railway, and other work. He was afterwards civil engineering assistant with the Consett Iron Company, co. Durham, and carried out there important sewerage and railway work.

After being for upwards of seven years engineering assistant to the Health Department of the City of Liverpool, Mr. Brodie was appointed in 1884 borough, water, and harbour engineer to the Corporation of Whitehaven, and in that capacity carried out extensive additions to the water supply, harbour works, sewerage and electricity works. He has occupied his present position since 1900.

Lady Volunteers for Road Sanding.—In the course of the last meeting of the Chislehurst, Kent, Urban District Council, the acting surveyor reported that six ladies had volunteered to assist with the work of sanding the roads during frost, and arrangements had been made to place sand at convenient spots for use by them whenever necessary.

Definition of the Term "Domestic Purposes" in General and Private Water Acts.

INSTITUTION OF WATER ENGINEERS' DISCUSSION.

A lively and interesting discussion followed the reading at the recent winter general meeting of the Institution of Water Engineers of the paper on the above-mentioned subject prepared jointly by Mr. A. B. E. Blackburn (Sunderland) and Mr. Percy Griffith (Westminster). The full text of the contribution was given in our issue of the 17th inst.

Mr. H. Ashton Hill (South Staffordshire Water Company) said he had made a few notes, the first of which had reference to the author's statement: "Nevertheless, it may fairly be asked whether it is not time to reconsider the whole question of domestic charges on its merits and devise some method, first, of limiting the application of the term 'domestic purposes;' and, secondly, of adjusting, if necessary, the rates of charge as between 'domestic' and 'non-domestic' user." But how were they to do it? It was dealt with somewhat later in the paper, where it was said that it would be necessary for each undertaking to get what they wanted by Parliamentary Bill, or get an amendment of the Model clause. It seemed to him one direction in which they would like to advance the subject was as to how it was to be done. With regard to this point, he was reading as he came to the meeting a document issued by Mr. Griffith some time ago which put that point of the subject very clearly. His next point had reference to the statement of "what quantity of water and what specific uses of water are to be considered as essential to health;" and the further statement as to the engineer being able definitely to calculate his liabilities, both in regard to quantity and quality. They knew what difficulty the Royal Commission on Sewage Disposal had had in trying to find a standard for sewage, and he fancied they would have the same, if not a greater, difficulty in adopting a standard for water. As to the liability as to quantity, if they began to talk about that it meant putting on meters. The disadvantages of metering domestic supplies universally in this country had been recognised, and it had been generally agreed that it was cheaper to waste a great deal of water than go to the

EXPENSE AND INCONVENIENCE OF ADOPTING METERS.

As to the consumers' point of view, the authors said the individual consumer must be prepared to pay his fair share; but he did not do so at present. Now the poor man got a great deal of water at a very small charge, while the rich man, who probably did not get more water, paid a good deal. He did not suppose they wanted to disturb that principle, and he did not know whether that was what the authors meant. Under the heading of "The Engineer's Point of View," the subject of trade supplies was dealt with, and at the time the paper came to him he had just considered a case which he might give as an illustration. It was the case of a works which already had two metered supplies. Formerly these supplies were not metered, as it was held at the time that they were for domestic purposes—for drinking purposes for the work people. All the water the work people wanted for manufacturing purposes they got from a canal. However, subsequently the two supplies were metered. The present application was to lay a fire main into the works, and further to take a service pipe from the end of the fire main for another drinking supply. The firm questioned his company's right to make the demands they made, and, indeed, they might have read the paper, for it was seldom anyone tackled them in the way they did. Their solicitor came to see him, and he was able to satisfy him in the usual way. (Laughter.) He had never found any of the difficulties which were spoken of in the paper. He found it quite easy with the present law. He explained to the lawyer that if one could not get a thing one way, one got it another if one had the power. Why should they try and restrict themselves when they knew that consumers were well able to look after themselves. When they went to Parliament other people were well able to look after their interests, and why should they as water undertakers go to meet them half way? Let well alone—water well. (Laughter.) Well, in the particular case he was referring to he was tackled as to the maintenance of the fire main, and got them to agree to his doing the work, for which they would pay—they could not open the ground, and his company could. They then wanted to know why they could not have the service pipe at the end of the main without a meter, and he told them they couldn't, and that was the end of it. (Laughter.) The authors referred to the question of metering supplies for non-domestic purposes and leaving the other supplies unmetered, but they had to remember that there were some people who under such circumstances would give a preference to the unmetered supply. They had known and heard of such cases. He hoped it would not be thought he was unduly criticising the paper, because he really felt they were greatly indebted to the authors for taking the trouble they had and putting the matter in the light they had, but it was only by criticism and by statements of their own experience that they could go forward. The authors spoke of the needless multiplication of lavatories and other sanitary conveniences in private residences, and he hardly knew what was meant. If a man liked to have a water-closet for each floor, and one for the servants, and one in the yard for his gardener, he did not know whether they were to restrict him to only having one. He had a note with regard to the statement under the heading of "Main Objects in View," in which reference was made to a system or

SCALE OF CHARGES

which would be equitable as between different classes of consumers. He knew there were different principles with regard to charges for water, and one was to get as much as they could and give as little as they could. Another principle in estimating these charges was to take a fair view of the probable quantity of water which would be used, and then, according to the scale of charges, if it was a meter supply, give that much water for a certain sum and charge for anything registered by the meter over and above that amount. There was a system with which he was familiar, although he did not know if it generally obtained, where the difficulty was overcome in this way. Supposing they had a combined supply to a house to which was attached a use for water which was not domestic, and supposing that house was rated at £100 a year, if it was not an expensive town for water the water rate might be £5 on that. There might be other use for water on the premises which might amount to £40 a year. Then they would take the two figures together and say, first, they must be sure of the rateable value they were entitled to. In other words, they must have the £5, and then they would put on the addition, whatever it was, and say, "We will allow so much water for that sum." That they would put as the minimum. He did not find the smallest difficulty in making arrangements with his consumers in dealing with that aspect of the question. Later on the authors spoke of legislative action which would seriously disturb the present method of supply; but he was optimistic, and did not see any cause for alarm. Later on suffering was described, but he did not know what it was—he was not a sufferer. (Laughter.) Then it was suggested that the law should be invoked in aid of the officials, and he would vote for that, for he considered it a good point. (Laughter.) On the subject of differential treatment, reference was made to the non-domestic uses of water which might be beneficial to a community, as, for example, supplies to trades which might be attracted to a particular area because the charges for water were low. He had marked on his paper "good for ale," because he came from the neighbourhood of Burton, but there might be other reasons. The authors seemed very anxious for the consumers and thought there should be uniform charges; but they must remember that there were many small undertakings which could only live by supplying perhaps one large consumer with gas and water, and as a matter of policy they would have to make differential charges. As to the need for classifying the conditions affecting the various non-domestic or extra-domestic supplies under heads, he thought

that Act as it at present [illegible] But by scheduling special [illegible] Acts of Parliament were they not tying themselves down? Still, there was to be a loophole. [illegible] to go to the Local Government Board. He did not know whether the board would like the [illegible] thrown on them. They might have the cattle, or a horse or a sheep in the churchyard, but if they had to deal with a zebra they would have to go to the Local Government Board before they could [illegible] Take the cases of [illegible] gasholder tanks and petroleum tanks. They were [illegible] ordinary but such things came along, and if they did such things they would be making an illegal charge unless it was sanctioned by the Local Government Board.

Mr. C. B. NEWTON (Hull) said the paper they had [illegible] was a very clear statement of the position which had disturbed the minds of those engaged in the business of water supply. The trouble experienced by the Metropolitan Water Board appeared to him to centre in the fact that too little regard was paid to the variations in the intensity of water consumption between one class of property and another. [illegible] 1897 empowered the raising of a [illegible] rate for domestic supply, and the only variation allowed was a rebate of 20 per cent in cases where the premises were assessed at a rent exceeding £300 per annum, and then only when the premises were not charged with Inhabited House Duty. The charge [illegible] of water was 5 per cent on a house in the suburbs rated at £50, and 5 per cent on a [illegible] offices in the city rated at £1,250. In the first case the rate produced 50s. per annum, and in the second case, after allowing the rebate, it amounted to £50 per annum. It was quite conceivable that the actual consumption of water might be identical in each case. There was clearly something wrong in this scheme of charges. The water undertaking must be provided with an income sufficient to meet all liabilities, but the burden should be more fairly distributed. Further, he thought that modern sanitary requirements and the improved conditions under which they now lived had entirely disposed of the old 5 per cent water rate on dwelling-houses. In these days a rate of 7 per cent appeared quite reasonable, and many large undertakings had imposed 10 per cent. To charge a rate suitable for dwelling-houses on the heavy assessments carried by lock-up premises in business thoroughfares was an imposition, and, as it was out of proportion to the quantity of water used, or the service rendered, it was wrong whichever way they took it. Most large cities and towns in the provinces did these things much better. It was the fashion just now to standardise everything. But were they sure that if it were possible to standardise a definition of a "domestic use" of water that this in itself would remove all difficulties? Probably their troubles would only begin when this was done, and, judging from the paper on which the authors had bestowed so much labour, he rather thought that their own phrase "a vista of further litigation" summed up the future prospects. He would submit that a

KEY TO THE SOLUTION OF THE PROBLEM

was to be found in sec. 12 of the Waterworks Clauses Act, 1863. Here they had certain uses of water—for cattle, for horses, for trade, for watering gardens, and for other purposes—expressly excluded from domestic uses. Surely it would be comparatively simple for each water authority to settle for its own area the particular uses which should be regarded as suitable for exclusion and specify each and every one in their private Acts. This should establish a negative definition as a harbour of refuge from these troublesome matters. As a practical method of dealing with the rather difficult case of the combined domestic and business supply, he would advocate the more general application of the principle of affording such supplies by measure, but insisting, as referred to by Mr. Ashton Hill, on a minimum charge corresponding to the domestic rate. The excess consumption beyond the value of the domestic charge would then very properly come into the account as an extra. This, in his opinion, was a simple and safe method of dealing with the difficulty.

Mr. E. ANTONY LEES (Birmingham) said in considering the subject they must keep in view what the authors had in their minds, which was rather to search out for some basis for some new arrangement which might be equitable from the points of view of the water undertaking and the consumer and the public, rather than merely sum up for them the position in which they all found themselves in consequence of recent legal decisions. Personally, he was rather disappointed in reading the paper that the authors had avoided these topics, but on further consideration he felt his disappointment was unreasonable in view of the objects the authors had set before them, which was to lay the foundations for what they conceived to be a more equitable system in view of all the interests concerned. What he had to say had been to a large extent anticipated by the previous speakers; but there was still something which might be usefully said on different points. Exception seemed to be taken to the system followed by the Metropolitan Water Board Act of a uniform rate. Personally he did not acknowledge the complete inequity of that. He thought that a uniform flat rate, with appropriate allowances, was

A PROPER WAY TO PROCEED.

Where the Metropolitan Act came short was that the allowances made in special circumstances were not altogether appropriate. Mr. Newton spoke of a house rented at a certain figure in the suburbs, and of other premises rented at the same figure in the City, and said that one had to pay perhaps ten or twelve times as much as the other, and he seemed to think that was in itself inequitable. Well, if it was not equitable, they had many instances of it. There was a rateable value fixed according to the position and the importance of the premises. Probably the cost for street cleaning would be no more to the authority than the house in the suburbs, which might even have more frontage, but it was felt that, in the interests of the public as a whole, there should be a uniform rate for street cleaning. Then, again, the premises in the City received protection against fire, and the risk was very much greater. The cost of fire insurance, however, was greatly reduced by reason of the supply of water to the City for dealing with fire. These seemed to him to be reasons why highly rated premises in the middle of a city should pay not merely for the water they consumed, but for the provision of the public supply at a flat rate similar to that levied in less expensive areas. But he did recognise that there was a proper differentiation not on the ground of difference of rateable value, but of difference of user. In one case they had a block of offices in the City which was only partially occupied, while an ordinary residence was occupied the whole time, and there were the daily meals being cooked, and the morning ablutions, and so on. In the City it was only an occasional need during the day which called for the consumption of water. It seemed reasonable, then, that the question of partial user should come in, and should go to provide for a reduction in what one might term the flat rate. Then came in another consideration, that the supplier of water wanted to be protected in the respect that a partial occupation should not only theoretically, but should actually entail a partial consumption of water. Then they introduced the principle which Mr. Ashton Hill referred to—viz., the putting in of a meter and charging a half, a third, or any proportion they chose to fix upon; and for that charge giving a proportionate amount of water and charging for anything beyond at the trade rate. Thus, if on the upper block of City offices they had a photographer, or a chemical laboratory, or any of the chamber trades which were

TREMENDOUS CONSUMERS OF WATER,

the supplier was protected by the meter. In Birmingham they had recently obtained a revised scale of charges, and this was obtained after the decisions in the Avery and Oddenino cases. By intelligent anticipation they proceeded by the methods suggested by the authors. Their old Act prescribed quite a definite scale of charges for domestic uses—that was compulsory uses. Instead of going for a new Act they obtained a Local Government Board Order whereby the board clothed themselves with the power to sanction scales of charges for water in Birmingham, such scales of charges to be submitted to them from time to time. Having obtained their Order giving the Local Government Board that authority, they introduced their scale, and had obtained it. The rates were very high, for reasons he need not discuss, but which most members were familiar with. The point he wanted to call attention to was this. In respect to the supply to hotels, public-houses, restaurants and clubs, they had introduced what, so far as he knew, was a new principle, and which he ventured to think contained in it the germs of a way out of all their difficulties. They all knew that certain uses of water in public-

houses for which many of them had been accustomed to make special charges were declared in the Amery case to be included in the domestic rate. On the other hand, the value of the licence was included in the rateable value, and the publican might reasonably say that he was paying for the uses incidental to his trade by such increase of rateable value. Now the method they had adopted was this—they offered to allow the consumer in a hotel a rebate of 25 per cent on the full domestic rate, and that "plus a charge for baths, or according to the size of the meter, whichever was the greater, divided by four, shall provide the domestic minimum." That was only applicable where the premises exceeded £80 a year of rateable value. By that method they made it worth while for the consumer to practise economy in the use of water, and the supplier was protected by the presence of the meter and the provision that the supply should be charged for according to the meter scale in operation for the time being. They applied the same principle to factories by having a modified domestic rate going down as low as 3 per cent, and then putting in a meter giving again for the domestic rate, divided by four, such a quantity as was allowed by the meter scale. They had recently had a revaluation of the machinery as included in the rateable value, and in consequence of that it had been necessary in the case of *bonâ-fide* factories to make a still further concession, or otherwise the charges would have been unreasonably excessive. This was by the sanction of the Local Government Board, and it sanctioned the principle which Mr. Hill and Mr. Newton had referred to. He believed theirs was the most recent scale of charges, and seeing that it had been sanctioned by the Local Government Board, and met that need for protection which water authorities had experienced in consequence of the Avery decision, he thought it was of considerable interest to the members of the institution. With regard to other matters dealt with by the authors, he would like them to give references to the laundry cases referred to.

Mr. C. H. PRIESTLEY (Cardiff) said it appeared to him that the last speaker in the first place tried to make out that the flat rate was not inequitable and afterwards showed that it was to a certain extent inequitable, and he could not quite see how he reconciled the two statements.

THE FLAT RATE

seemed to be inequitable, for the reasons pointed out by Mr. Newton, but it might be got over in another way to that suggested by Mr. Lees. In fact, he believed they had got over it for a number of years in Manchester, where he thought there was a penny rate for water supply, in addition to the usual domestic rate. Of course, the rate could be made higher than one penny if necessary. It seemed to him that the domestic rate should in the first instance be fixed on a reasonable basis, and if that was not found sufficient, then, instead of putting it upon certain consumers, as the Metropolitan Water Board did, there should be this extra rate applicable to all premises of the nature of a rate in aid. In connection with the standard rate of charges mentioned by the authors, he thought no one could assume that the same quantity of water ought or should be supplied in such a place as Cheltenham as to the slums all round large cities. It seemed quite out of the question that any given quantity of water per head was reasonable and proper for every place, for they knew quite well that in such places as Brighton, Cheltenham, and different watering-places the use of water was very considerably more than in such places as Sheffield or Manchester per head of the population, and he did not think that any equitable basis could be arranged for the supply of a given quantity of water per head of the population. In connection with the remarks of Mr. Ashton Hill, he might say that neither his committee nor himself had ever found any of those difficulties which seemed to be so prevalent among members of the institution. In the last thirty years he had never had any question over the charges for water. Their Act of Parliament defined the domestic supply and the rate to be paid—viz., 5 per cent under £20 rateable value, and 4 per cent over £20 rateable value. So far as they were concerned, at any rate, their Acts of Parliament were, and always had been, sufficient for the consumers. He was glad to see the authors had taken

A VERY LIBERAL VIEW

of the users of water for domestic purposes. Personally he believed they could not take too liberal a view, because he thought it was for the benefit of the health of the people that they should use water in baths, and so on, as much as possible. He did not quite understand what was meant by "financial position" in the sentence, "that the payment for this quantity must be adjusted according to the financial position of the consumer." Then the authors said that water for domestic purposes involved a much larger consumption now than in the year 1847, and that this extra supply had generally been afforded without demur by the water authorities. At the same time these authorities had had to lay out considerably more money than was effected in 1847. It was also stated in the paper that at the same time there had been a considerable increase in the demand for trade purposes supplied at remunerative rates of charges. That might be so in some cases, but not in every case. In his district one of their largest consumers—the docks—had to be supplied at a rate something like 50 per cent below what the water actually cost. There was an obligation to supply under an old Act of Parliament. He agreed that there should be some definition of pure and wholesome water, but any general definition was not applicable to every district in the country. There might be certain districts well situated to supply an absolutely pure water, but other districts could not do so. It was further stated by the authors that in all manufacturing areas a considerable proportion of water is used for supply to factories and workshops. In his case the bulk of the supply was for dock purposes. In Cardiff their "trade purposes" were 12½ gallons per head, as against a total consumption of 28 or 29 gallons per head, the rest being for domestic purposes. He agreed with what one speaker said as to the multiplicity of lavatories and as to gardens. With them, and he believed in most cases, the garden was assessed as part of the premises, so that the people who occupied the house paid for a garden supply, and he did not think it right to charge anything extra for garden purposes. He did not mean that they should use water through a hose, as that was a mechanical use.

(To be concluded.)

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάντ' ὁρᾷ
(One man does not see everything.)
—EURIPIDES.

MUNICIPAL POLITENESS.

To the Editor of THE SURVEYOR.

SIR,—It is easy enough to write the blustering type of letter, signed "Applicant," which appeared in your issue of the 24th instant. Had the writer of this been acquainted with the situation of the official who wrote him, he would indeed have seen the other aspect of the case. Briefly, the official mentioned is having to conduct a large practice, of which the town's business is but a small part, without the help of his son—who is fighting for "Applicant" in the Dardanelles—and also with a reduced staff.

If "Applicant" only knew it, he could not have been dealing with a finer type of man; some day, perhaps, he will know the effect of work, anxiety and age.—Yours, &c.,

NEMO.

December 28, 1915.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS: NOMINATIONS FOR COUNCIL, 1916-17.

To the Editor of THE SURVEYOR.

SIR,—The attention of members and Associate members of the Institution of Municipal and County Engineers is directed to by-law 14, and particularly to the following portions thereof:—

". . . each Member or Associate Member of the Institution shall be at liberty to nominate one Member or Associate Member for the Council. . . . Members' or Associate Members' nominations must be received by the Secretary not later than February 1st in each year, and must be accompanied by the written consent of the nominee. . . ."

It should also be noted that under the provisions of by-law 10 no ballot list will be sent to any Member or Associate Member whose subscription for the year commenced May 1st, 1915, remains unpaid.

By order of the Council,

J. W. DUDLEY ROBINSON,
Secretary.

92, Victoria Street, S.W.,
December 28, 1915.

LOCAL AUTHORITIES' ECONOMIES.

AN EDINBURGH REPORT.

Mr. Robert Paton, the city chamberlain, has issued to members of the Edinburgh Town Council a report on economy in municipal expenditure which he was asked by the Treasurer's Committee to prepare. The report (says the *Glasgow Herald*) is of considerable importance as being the first of a series to be submitted to their respective town councils by the chamberlains of the various Scottish cities. The matter is dealt with in two parts—namely (1), the reductions which are being effected in the city's expenditure during the current year as compared with the amounts fixed by the magistrates and council in their estimates of July last; and (2) the possible changes in the city's administration which may be submitted for the consideration of the town council with a view to ascertain what permanent economies may be carried out after the war is ended. With regard to Part 1 the chamberlain says: Six months of the financial year have passed, and I am now in a position to state that, generally speaking, the actual expenditure has so far been kept well within the estimated figures. Staffs have been further diminished by enlistment and otherwise, and in all cases where it has been possible to carry on the administration without filling up the vacant posts this has been done. It is too early yet to make any reliable forecast of the probable financial result at the close of the year, but the committee may take it that the object which they had in view in asking for this report is being fully achieved so far as Part 1 is concerned.

PERMANENT ECONOMIES.

With regard to economies of a permanent kind, the chamberlain points out that of the estimated gross expenditure of £796,395 there is fixed or outside the scope of the review expenditure amounting to £403,433, leaving £392,962 which may appropriately be subjected to scrutiny. The principal items are salaries and wages, £222,246; public lighting, £30,265; repair and maintenance of properties, £20,869.

Under the heading of salaries and wages, he says: Savings under this head may be effected by reducing the rates of salaries and wages, and by reducing the staffs. The rates of salaries and wages are fixed by the town council, but it is open to the council to reconsider them at any time. The subject of alterations of salaries and wages, having regard to the amount of money involved is one of the most important which the council has to consider, and it seems to me that the preliminary work connected with it would be more effectively done by one special committee than by the several committees, which are apt to take different views of the same question.

PUBLIC LIGHTING.

There is room for permanent curtailment of the expenditure under this head. The restricted gas lighting last winter demonstrated how small the actual minimum necessities of the city are. The over-illumination of pre-war days arose from the fact that the old flat-flame burner was replaced by the incandescent mantle—that is, 45-candle power was substituted for about 5-candle power, while the distances between the lamp-posts remained the same. In the case of most of the streets it will be found that one-half the number of lamps will provide a sufficient measure of lighting. This would represent a saving of about £7,500 per annum in wages and in gas consumed. A further saving may be effected by a system of automatic lighting. The restricted lighting by electricity both last winter and this winter has shown that there is room for reduction of the expenditure under this head also. From £1,500 to £2,000 per annum could be saved in this way.

The control of the expenditure on the repair and maintenance of properties is in the hands of the city superintendent of works. It is a large item (£20,869), but it covers a large number of properties. Only such repairs are undertaken as are necessary.

It may not be wise to look for any material reduction in the average amount which has been expended on renewals of streets in recent years, but it is, of course, for the council to determine whether the present high standard of efficiency in paving is to be deemed absolutely essential for the immediate future. The chamberlain here raises the question whether work by direct labour—that is, work carried out by the corporation's own employees—is as economical as work done by contract. A contractor would probably do it more rapidly and more cheaply than the corporation by its own workmen, though it is open to doubt whether the quality of the work would be as satisfactory. It is not certain, however, that the corporation gets full value for its money under the present system. Tests of the cost by both methods should be made, and the comparative results carefully weighed. The corporation endeavours to be a model employer, and it should therefore obtain the highest standard of workmanship; in other words, it should get a good day's work for a good day's pay.

The chamberlain observes that the council may resolve to undertake in the future no capital expenditure for unremunerative purposes for some time, save what is absolutely unavoidable, or what promises to be an exceptional investment for the good of the city. It will not be practicable, and it is not necessary, to lay down any rule for regulating capital expenditure of a remunerative kind. Demands for extensions of electric lighting and power and also tramways will have to be considered and decisions taken upon them from time to time as they arise, just as in the past. That the city will have to face a large expenditure in connection with tramways in the not distant future is probable, but it would be wise to resolve that the old tramway debt should be cleared off before the new one is incurred.

Reductions in staff can be carried out without dispensing with the services of permanent employees, or, to put it another way, reductions may be effected by the non-filling up of vacancies existing now, and others which will emerge before the close of the war.

QUESTIONS IN THE HOUSE.

In the House of Commons, on the 22nd inst., the President of the Local Government Board was asked what steps the Board had taken to bring about economies in municipal administration; and in how many London boroughs had the rates been reduced since the beginning of the war.

Mr. Long, in reply, said his department took every opportunity of impressing on local authorities the urgent need for economy. Practically no loans were being sanctioned, except in connection with war work. Some boroughs contained several different rating areas, but he found that the rate was lower in twenty-three rating areas in the Metropolis for the year ending March, 1916, than for the previous year, and was lower in twenty-six areas for the half-year ending March, 1916, than for the half-year ended March, 1915.

On the following day the Prime Minister was asked whether he was aware that numbers of men were still being employed in the construction of new railways, harbour works, reservoirs, public works, and buildings; whether he was aware that the reason for this was that there was no war legislation providing for the temporary cessation of these works on equitable legal terms; and whether the Government proposed to take any steps in the matter.

Mr. Pretyman, who replied, said that if the questioner would give particulars of any work of this character which he considered unnecessary, he would look into the matter.

On the same day, the President of the Local Government Board was asked whether he was aware of the action of the Hertfordshire County Council in laying down wood pavement at the present crisis from Bushey to Watford, and of the Middlesex County Council in duplicating for 100 yards, more or less, the side walk of the main road between Edgware and Stanmore, presumably for the convenience of one householder, and to save him the trouble of crossing the road; and whether, in view of the need for economy on the part of local bodies, he would again enjoin on local bodies the imperative need of reducing the rates.

The Parliamentary Secretary to the Local Government Board (Mr. Hayes Fisher) said the President of the Board was in communication with the local authorities named.

Revenue from Old Iron.—It was reported at a meeting of Edinburgh and Leith Corporations Gas Commissioners on Monday that £2,700 had been realised by the sale of old iron which had been expected to yield only £700.

Municipal Motor 'Buses.—Erith Urban District Council are applying for a Provisional Order to enable them to run motor omnibuses inside and outside its district. No objection will be raised by the Board of Trade nor by local authorities in adjoining areas—including Woolwich—into which the omnibuses will run. If the Order is granted, this will be the first system of municipal motor omnibuses to be worked in the London area.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Chesterfield T.C.—A proposal is being considered for the purchase of a site in Walton Fields-road for the purpose of a depot.

Ebbw Vale U.D.C.—It is proposed to provide offices at the fire station at an estimated cost of £140.

Grangemouth T.C.—Inquiries are being made with respect to a site for a public slaughter-house.

Sleaford R.D.C.—It was reported that the site of the water tower at Evedon cost the council 35s., but that the legal expenses in conveying the land amounted to nearly £40. Mr. Morley: It means that either the land was very cheap or the costs were very dear.

HOUSING AND TOWN PLANNING.

Altrincham U.D.C.—Inquiries are being made for a site for the purpose of a housing scheme.

Irlam U.D.C.—Tenders are being invited for the erection of seventy-eight working-class houses.

Thurles R.D.C.—An intimation has been received that the Local Government Board had finally decided to exclude from the council's housing scheme thirty-six out of the sixty sites, and they therefore decided to withhold £4,680 of the loan of £10,000 applied for, and pointed out that if those cottages were to be built the expense would have to be met out of the current revenue or by a supplemental loan to be obtained in the open market, subject to their sanction. It appeared also that the council pointed out that difficulties might arise with contractors who had signed bonds, and the Local Government Board replied that the contracts could be cancelled in some cases, as they had not commenced the work, and the time limit had long since expired. The council decided to supply further evidence to the Local Government Board as to the unfitness of the present dwellings of the applicants, and to ask the Local Government Board to indemnify the council against any possible actions by contractors.

Wrexham T.C.—The Local Government Board have written expressing the opinion that the proposed site for the erection of thirty working-class houses was not a desirable one. The land belongs to the corporation, and the scheme included the provision of a new slaughter-house in proximity to the houses. The matter has been referred to the Health Committee.

York T.C.—The Health Committee have been informed by the Local Government Board that they are unable in the existing circumstances to sanction a loan for the acquisition of the land in Tang Hall-lane, Heworth, for housing purposes. The committee have instructed the town clerk to ascertain if the Ecclesiastical Commissioners will extend the present option on the land until after the termination of the war.

ROADS AND MATERIALS.

Bexhill T.C.—The town clerk has been instructed to ascertain the terms of purchase of land on both sides of the railway for the proposed construction of a bridge over the railway to relieve the growing pressure of traffic over Sea-road Bridge.

Bideford R.D.C.—The council have resolved to make a claim against the county council for the heavy damage done to the district roads at Hartland and Clovelly in consequence of the traffic in connection with the remaking of the Hartland main road.

East Grinstead R.D.C.—A letter has been received from the manager of the Road Board, Mr. H. P. Maybury, expressing keen appreciation of the work of the council's surveyor (Mr. C. Turton), in connection with the improvement of roads for military purposes, and stating that owing to his valuable services the work was carried out in an expeditious and economic manner. Mr. Maybury added that the board would like to show their appreciation of those services by a small monetary payment to Mr. Turton, if the council had no objection. The council decided to reply that they were glad their surveyor's services were appreciated.

Hornsey T.C.—In consequence of the reduction of work on the highways it has been decided to sell one of the five road rollers.

Huddersfield T.C.—The borough surveyor, Mr. Andrew M. Ker, has received instructions to proceed with the paving of certain portions of Liverpool-road and Mersey-street.

Knaresborough R.D.C.—The chairman, Mr. W. Atkinson, presented his report of the county council conference on economy in expenditure, which he attended as the council's representative. He said there had been a tremendous increase in the cost of the highways, which in 1890 cost £95,000, and last year cost £200,000. There were a few departments of the county council where there was a slight decrease, but not many. Among the suggestions made at the conference was one recommending the council not to metal the roads, but "do them up" as best they could, and another that tar-spraying should be abandoned. He (the chairman) thought those suggestions "penny wise and pound foolish." He considered that money spent on the tar-spraying of the roads was well spent, and those roads did not cost as much to keep in repair.

Norwich T.C.—It has been decided to make up Recorder-road at the expense of the owners.—The town council have accepted the tender of the Enderby and Stoney Stanton Granite Company, Limited, to supply 1,000 tons of Earl Shilton stone at 14s. 6d. per ton.

Oystermouth U.D.C.—The surveyor, Mr. W. P. Puddicombe, has received instructions to prepare a scheme for making up Summerland-lane, towards the cost of which the owners of property have promised a contribution.

Radstock U.D.C.—The surveyor, Mr. G. H. Gibson, presented his estimate for the repair and maintenance of the main roads for the year ending March 31st, 1917, amounting to £999. No provision whatever was made for any improvements, and the estimate was based on an average expenditure for the last three years, plus the extra cost of materials and labour.

Rotherham R.D.C.—The clerk has been instructed to negotiate for the purchase of land, with a view to widening the Bawtry and Tinsley main road at certain points.

Thetford T.C.—Replying to comments with respect to the condition of the streets, the borough surveyor, Mr. W. Jones, stated that owing to a shortage of labour and horses he had not the men at his disposal to keep the streets cleansed. It was a question whether they left the roads or scraped them, and gathered up the scrapings when they could. The Mayor said he did not think they could do any more than they were doing at present.

West Ashford R.D.C.—The surveyor, Mr. A. Sims, has been instructed to repair the roads in the vicinity of the Pluckley remount barracks.

Westminster B.C.—The tender of the Limmer Asphalte Paving Company, Limited, at £1,649 per annum, is recommended by committee for acceptance for the maintenance of the carriageway of Victoria-street, for a period of five years.

SEWERAGE AND SEWAGE DISPOSAL.

Belper R.D.C.—The surveyor, Mr. R. C. Cordon, reported that he had received £56 from the sale of mangolds and potatoes at the Duffield sewage disposal works.

Coventry T.C.—Mr. W. H. Grant, chairman of the General Works Committee, in presenting the reports of the city engineer, Mr. J. E. Swindlehurst, on flooding and its remedies, said within a few years it would be necessary to spend from £100,000 to £200,000 in resewering the streets in the centre of the city; but it was no use talking about any large expenditure now, with the vetoes of the Local Government Board and the Treasury on borrowing. He thought the flooding which had taken place during the year was due to the fact that the sewers were no longer adequate to deal with abnormal rainfall. The population had

increased from 25,000 to 27,000 in the last five years. When the war was over a scheme or schemes for dealing with the difficulty would be presented.—The council on Tuesday agreed to a proposal to allow the hutments for 2,000 women and 300 family houses to be erected at Holbrook's-lane, outside the municipal area, to be drained into the city sewers, in consideration of an annual payment.

Chipping Norton T.C.—It has been decided to purchase new media to refill two contact beds, and to renew certain pipes at the bottom of the beds. The question is also to be considered by the Sanitary Committee of emptying the remainder of the contact beds and refilling them with new media. Councillor Collis raised the question of tank flushes to all water closets, as recommended by the medical officer in his report. It might be argued that the present was hardly a suitable time to force the work, but there was no doubt that would hold good for some years yet. He therefore felt it was their duty to take some steps in the matter. Councillor Bolwell said the question had been before the Sanitary Committee several times, and it was thought that nothing should be done at present in regard to already constructed water-closets unless there was clear proof of a nuisance.

Paignton U.D.C.—The surveyor, Mr. C. O. Baines, has received instructions to prepare another scheme for the more efficient draining of the land at the rear of the sea wall.

Stirlingshire C.C.—The clerk to the Central District Committee (Mr. Lapsley) reported that he had received the report by Mr. Greig, surveyor, on the proposed scheme of drainage for Cambusbarron, and as instructed he had sent a copy to the town council, at the same time requesting the council to state on what terms they would grant the connection from Cambusbarron to their sewer.

Wharfedale R.D.C.—Some time ago a scheme to cost £6,761 was approved by the Local Government Board for the sewerage of the village of Adel, and it was arranged that the Leeds Corporation, whose boundary adjoins that of Adel, should continue their main sewer in order that the sewage could be treated by them. On the outbreak of war only about half the scheme had been completed, and a sum of £3,000 was spent. The Leeds Corporation then wrote stating that owing to the altered conditions they could not carry out their part of the contract, and while the contractor for the rural council would not agree to a suspension of the work he was willing that his contract should be broken. The difficulty of the Wharfedale authority is that their £3,000 has been spent to no purpose if a union cannot be made with Leeds, and the case therefore is to be submitted to the Local Government Board to hold an enquiry.

WATER, GAS, AND ELECTRICITY.

Middlesbrough T.C.—The gas and electricity undertaking shows this year a profit of £40,000.

Mid-Lothian C.C.—It was reported that a committee of the Flotterton and District Water Board had intimated that they were advised by counsel that their present procedure, by which they supplied water to the local authorities in the county, was absolutely illegal and not contemplated by their Act. It had been suggested that a provisional order should be obtained from the Council at Session, and the board agreed to.

Ripon T.C.—A scheme for the enlargement of the gasworks, at an estimated cost of £7,000, is recommended by the Gas Committee.

MISCELLANEOUS.

Chertsey R.D.C.—The surveyor, Mr. C. G. Atkins, reported that since June 14th last up to the present time he had been using his motor cycle on council business, and had covered 2,400 miles, or an average of 400 miles per month. The use of locomotion had enabled him to carry out his duties more efficiently than would otherwise have been the case, and he asked that the council should consider the question of making some allowance to cover the running expenses. Answering the chairman, the surveyor said the running expenses amounted to £20 per annum.—Mr. Edenborough said the request was a very reasonable one. The matter was allowed to stand over until the next meeting.

Margate T.C.—It is proposed to purchase a petrol motor fire escape, with accessories, at an estimated cost of £1,150.

PERSONAL.

Mr. Robert McNicoll, county sanitary inspector of Perthshire, has enlisted under Lord Derby's scheme.

Mr. D. Hinchcliffe, surveyor to the Shepton Mallet Urban District Council, has joined the Royal Engineers.

Mr. F. A. Barnes, city surveyor of Truro, has been voted 25 guineas for his work in connection with the reconstruction of the municipal buildings.

Mr. Edgar F. Willson, surveyor to the Kingsbridge (Devon) Rural District Council, has been appointed surveyor to the Saxmundham Urban District Council.

Mr. William Mackenzie, county sanitary inspector, has been appointed sanitary inspector and housing officer for the Western District of the Ross and Cromarty County Council.

Mr. R. J. Glass, burgh surveyor and sanitary inspector of Maybold, has been appointed sanitary inspector to the Bathgate District Committee of the Linlithgow County Council.

Mrs. Eleanor Thurlby has been appointed assistant sanitary surveyor to the Wortley Rural District Council, to act during the absence of her husband, Mr. F. Thurlby, the sanitary surveyor, who has joined the London Rifle Brigade.

Mr. F. Wood, surveyor to the Horncastle Urban District Council, and Mr. E. Park, surveyor to the Horncastle Rural District Council, have joined the Royal Engineers together, and both councils are keeping their positions open for them.

Mr. G. A. Waite, ASSOC.M.INST.C.E., temporary assistant city engineer and surveyor of Salisbury, and formerly engineering assistant of Rochdale and Bradford, has been appointed temporary surveyor and water engineer to the Portland Urban District Council.

Mr. A. R. Finch, borough engineer and surveyor of Kensington, has been advised by his doctor that, unless he can relieve some of his work, the unsatisfactory condition of his nervous system pointed to a breakdown, which would incapacitate him entirely. The Finance Committee of the borough council have accordingly decided to grant him complete freedom from duty for three months.

Mr. P. R. Gibbs, divisional surveyor for No. 1 District under the Worcestershire County Council, has been granted a commission as 2nd Lieutenant in the 14th Worcestershire Regiment, Pioneer Battalion. The following members of the county surveyor's office staff have also been engaged on active service during the past year: Mr. B. C. Hammond, chief assistant, 2nd Lieutenant, Royal Engineers, in France; Mr. C. F. Walker, second assistant, Lance-corporal, 8th Worcesters, in France; Mr. H. T. Evans, third assistant, Legion of Frontiersmen, attached to Fusiliers, East Africa; Mr. E. Wall, pupil, 2nd Lieutenant, Royal Engineers, Fortress Company; Mr. A. H. Francis, chief clerk, Company Quartermaster-Sergeant, 2/8 Worcesters; Mr. E. F. Gravenall, second clerk, Sergeant, 3/8 Worcesters; Mr. G. J. Harman, junior clerk, 2nd Worcesters, France (now reported missing). This leaves only one member of the staff—viz., the third clerk—who was rejected for eyesight, but who has attested under Lord Derby's scheme, and who will be called up with the first group. In addition to the above, 150 out of the 450 roadmen have joined the Colours or are engaged upon munition work. One of the assistant surveyors —Mr. Roland Fletcher—and twenty-five men have, for the last four months, been engaged upon military road work for the Road Board.

OBITUARY.

Mr. F. S. Sargent, surveyor to the Dover Rural District Council, died recently, we regret to state.

Dearer Electricity at Islington.—At the last meeting of Islington Borough Council an increase of 15 per cent on the existing charges for electrical energy for private lighting and power purposes was made, to take effect from March next.

The Surveyors' Institution.—The next ordinary general meeting will be held in the lecture hall of the institution on Monday, January 10th, when a paper, entitled "Some Notes on Reinforced Concrete," will be read by Mr. R. M. Kearns (Fellow). The chair will be taken at five o'clock instead of eight o'clock.—In view of present circumstances the usual junior meetings will not be held this session.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Bentley-with-Arksey U.D.C. (December 23rd. Mr. A. G. Drury). £2,630, supplementary expenditure in connection with the scheme for sewerage and sewage disposal works. The clerk to the council (Mr. G. Pye) stated that the application arose chiefly out of a contract for sewerage works entered into in 1913, and the excess of expenditure over estimates was accounted for to a large extent by the nature of the ground—the running sand and water—and the bad ground generally in the Bentley Toll Bar district, which necessitated the timber being left in the trenches. A bad state of ground was also met with at the new pumping station in Bentley village, and necessitated an expenditure far exceeding the estimate. The original estimate for the work was £11,936, but the contract was let for £12,458. A representative of the engineers (Messrs. Balfour and Sons), gave details of the cost of various portions of the work, and in reply to the inspector, said the whole system now worked effectually.

APPLICATION FOR LOAN.

Newport (Mon.) T.C.—£1,025 for the construction of a new road.

LOANS SANCTIONED.

Hackney B.C.—£9,362 for contribution towards the cost of street improvements.

Preston T.C.—£3,140 for market offices and conveniences.

Raunds U.D.C.—£483 for the provision of a cemetery.

St. Pancras B.C.—£15,000 for the electricity undertaking.

FORTHCOMING INQUIRY.

JANUARY.	£
24.—**Tottenham.** For the purchase of land for a hospital (Dr. W. W. E. Fletcher)	8,643

FOR OTHER ADVERTISEMENTS
See End of Paper.

Just Published. Crown 8vo., Limp Cloth, Rounded Corners. Price 2s. 6d. nett.

THE REINFORCED CONCRETE REGULATIONS of the London County Council made July, 1915, under the London County Council General Powers Act, 1909, approved by the Local Government Board, and ordered to come into operation on 1st January, 1916.

A Handy Guide for the use of Architects, Surveyors, Engineers, and Contractors, containing the Full Official Text (by permission of the L.C.C.), with Explanatory Notes, Diagrams, and Worked Examples, by Ewart S. Andrews, B.SC.ENG., M.C.I., Consulting Structural Engineer.

Although the Regulations apply only to the London area, they are likely to be adopted throughout Great Britain, because they contain the most detailed requirements of any Official Regulations in the world, and also they have received the approval of the Local Government Board. Provincial authorities who apply for loans upon reinforced concrete construction will probably therefore conform to the Regulations which the Board have already approved.

B. T. Batsford, Limited, 94 High Holborn, London. (2,805)

WANTED A Temporary Clerk-Assistant in the office of the Engineer and Surveyor to the Rural District Council of Chelmsford. Preference given to one able to undertake the inspection of New Buildings under the Council's By-laws and using own bicycle. Applicants must be ineligible for service in the Army or Navy.

Applications in writing, stating previous experience and salary required, which must include travelling expenses, to be sent to Mr. J. Dewhirst, Waterloo-lane, Chelmsford, not later than the 10th January, 1916. (2,807)

TO SURVEYORS Particulars of luminon paint for street illumination can be obtained from Harry W. Cox & Co., Limited, 159 Great Portland-street, W. (2,806)

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it a fact, as stated in a leading technical paper the other day, that young women are more easily trained in the management of machine tools than youths? Is it not highly interesting to read that in a large munition factory "somewhere in the North," youths had been tried, and that at the end of six months they had made no progress, had damaged the machines, and were replaced by young women, who "in five weeks were doing far better work than the youths did after as many months"? Is it that the youths of this country are becoming demoralised by watching football matches and cinema shows, or what is the cause for this decadence?

* * * *

Why is it that we are becoming more and more fond of adopting American words and expressions? May it not be that our cousins across the water are able to make speech more terse and tangible? For instance is not the expression "road builder" better than that of "road engineer," as the former word includes engineers, surveyors, and contractors?

* * * *

With regard to economies by local authorities at the present time, is there not some truth in the suggestion that expenditure is increased by the present system of ward representation? Do not most surveyors realise at times that there is a tendency for the representatives of various wards on a council to endeavour to get work carried out in the district they represent, so as to secure the "good offices" of their constituents, and that this practice tends to the inevitable result that the wards vie with each other in securing large expenditure on works which otherwise could stand over for a time? What can be done to remedy this incentive to municipal expenditure?

* * * *

Who was it that invented the following formula for ascertaining the distance that a light motor car would travel on an ordinary road surface after the brakes had been applied with an amount of vigour compatible with safety: "Square the speed in miles per hour and divide the resultant by 10 gives distance travelled in feet. Thus a car travelling at 20 miles an hour could be pulled up in 40 ft., whereas a car travelling at 40 miles an hour would require 160 ft."? Has anyone tried this on a road, or could not some simple experiments be made so as to arrive at some good formula?

* * * *

Are there not two sides to almost every question? People have been laughing at the picture which has lately appeared in some of the illustrated papers showing women at work in excavating for a new underground railway in the city of Berlin; but does not this rather tend to show the work of a nation in deadly earnest? Could not some of us learn a lesson from this picture?

* * * *

Is there any real need for the newly constituted Institute of Arbitrators when we consider the large number of professional associations and institutions which are already in existence? Do not some professional men already begin to think that the multiplication of these institutions is not only hardly necessary, but that, on the other hand, it might be a good movement to endeavour to amalgamate some of those already in existence?

* * * *

What is to be done about our roads if they are to be much longer neglected for want of funds to maintain them? Although much can be done by the old stitch-in-time methods, must not a time come when resurfacing or reconstruction becomes necessary? Is it not a penny wise and pound foolish principle to neglect roads when it is possible to economise in other directions? Could not the somewhat lavish expenditure on public parks, public buildings, public baths, conveniences, street widenings, town planning schemes, and so forth be left in abeyance for more prosperous times?

* * * *

Do we give quite enough credit to our railway companies during this crisis for the part they have played in such an unostentatious manner? Do we realise the enormous number of troops, recruits, horses, baggage and war munitions of all descriptions that they have carried, in addition to their ordinary passengers

and goods, and the small amount of inconvenience that has been current to the public? Has not this organisation been a credit to the country, and an example of quiet strength, which should serve as a model of latent energy to everyone?

* * * *

When the war is over will there not be a very large number of disputes which can only be settled by arbitration? Are there not many contracts for the supply of road materials and other commodities entered into before the war commenced which cannot be carried out by the contractor, and have not the Local Government Board in more than one case of the kind suggested arbitration at the end of the war? Will there not also be many cases in dispute between the War Office and local authorities as to extra expense caused to the latter by reason of having to supply water to large camps or to troops quartered in various places, and in dealing with their sewage? Will consulting engineers thus be able to recoup themselves for their loss of employment during the war?

Women Gardeners for London Parks.—In consequence of the difficulty of finding substitutes for some of the gardening staff, the Parks and Small Holdings Committee of the London County Council propose to employ temporarily a few trained women gardeners, the rate of pay and conditions of employment to be the same as those applicable to temporary undergardeners in the council's service.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SURVEYOR'S CLERK.—December 31st.—Aldershot Urban District Council.—Mr. Fred. H. Dominey, acting clerk, Municipal Buildings, Aldershot.

SURVEYOR AND INSPECTOR.—December 31st.—Mayfield (Staffs) Rural District Council. £100 per annum.—Mr. R. Holland, clerk, Ashbourne, Derbyshire.

TEMPORARY ASSISTANT SURVEYOR.—January 1st.—County Council of Devon.—Mr. W. P. Robinson, county surveyor (No. 2 Division), 22 Queen-street, Exeter.

TEMPORARY SURVEYOR.—January 1st.—Horncastle Rural District Council. £150 a year.—Mr. J. E. Chatterton, clerk.

SHIFT ENGINEER.—January 1st.—Chertsey Rural District Council. 30s. per week.—Mr. L. Porter, assistant clerk, 80 Guildford-street, Chertsey.

SURVEYOR. — January 3rd. — Maybole Town Council. £100 per annum.—Mr. J. Gibson, town clerk.

TEMPORARY BOROUGH SURVEYOR.—January 3rd.—Corporation of Morecambe.—Mr. W. Tilly, town clerk, Town Hall, Morecambe.

SANITARY SUB-OFFICER.—January 3rd.—Corporation of Dublin. £78 per annum.—Mr. C. A. Cameron, Executive Sanitary Officer, Municipal Buildings, Dublin.

INSPECTOR OF NUISANCES.—January 11th.—Corporation of Merthyr Tydfil. £100 per annum.—Mr. T. A. Rees, town clerk, Town Hall, Merthyr Tydfil.

ASSISTANT ENGINEERS.—April 1st. — Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

PRESTWICH.—January 4th.—For the construction of a brick culvert, 2 ft. internal diameter, for the urban district council.—The Surveyor, Chester Bank, Prestwich.

WEST RIDING.—January 7th.—For the removal of two temporary schools to new site, for the Education Committee.—Education Architect, County Hall, Wakefield.

BARKING.—January 7th.—For the erection of a steel-framed building covered with corrugated iron, together with brick-lined engine well, and appurtenant works, for the urban district council.—Mr. R. A. Lay, acting surveyor, Public Offices, Barking.

GREENOCK.—January 8th.—For the erection of cottages and the construction of streets and sewers, for the corporation.—Burgh Surveyor, Municipal Buildings.

IRLAM.—January 24th.—For the erection of seventy-eight houses on three sites, for the urban district council.—Mr. R. H. Winterbottom, surveyor, Council Offices.

Engineering: Iron and Steel.

DURBAN.—December 31st.—For the supply of telephone apparatus and materials, underground cables, and cast-iron pipes, for the Telephone Department.—Messrs. Webster, Steel & Co., London Agents, 5 East India-avenue, E.C.

NEWTON-IN-MAKERFIELD.—January 3rd.—For the supply of two Lancashire boilers, a steam-driven gas exhauster, a direct-current set of 25-horse-power, cast-iron gas mains and specials, excavating trenches, erection of a boiler-house, and the construction of a reinforced-concrete tar and liquor well, for the urban district council.—Mr. R. T. Surtees, gas engineer, Gasworks, Newton-le-Willows.

GOSPORT.—January 4th.—For the supply of a flywheel, crank shaft, steam, and air eccentrics and spindles, for the urban district council.—Engineer and Surveyor, Town Hall, Gosport.

MANCHESTER.—January 5th.—For the supply of low-tension switchboard, for the Electricity Committee.—Mr. F. E. Hughes, secretary, Town Hall.

PORTLAND.—January 5th.—For overhauling and repairs to a set of three-throw deep-well pumps, fixing a set of engine gearing, and other works, for the Waterworks Committee.—Mr. A. S. Lilley, engineer and surveyor, Council Offices, New-road, Portland.

THURSO.—January 8th.—For the construction of concrete work at the west pier, for the Harbour Trustees.—The Clerk, Traill-street, Thurso.

ST. PANCRAS.—January 10th.—For steel constructional work, for the borough council.—Mr. C. H. F. Barrett, town clerk, Town Hall, Pancras-road, N.W.

VICTORIA (Australia).—January 12th.—For the supply of steel rails and fishplates, for the Agent-General for Victoria.—Messrs. John Coates & Co., 115 Victoria-street, London, S.W.

DARLINGTON.—January 12th.—For the supply and erection of coal bunkers and elevators, for the corporation.—Electrical Engineer, Electricity Works, Haughton-road, Darlington.

SOUTHAMPTON.—January 14th.—For the supply of 3 tons of cast-iron cylinder, 5 tons of steel cylinder, and 1 ton of wrought-iron pump and hanging rods, for the corporation.—Waterworks Engineer, 33 and 35 French-street, Southampton.

SOUTHAMPTON.—For the supply of 3 tons of cast-iron cylinder, 5 tons of steel cylinder, and 1 ton of wrought-iron pump and hanging rods, for the corporation.—Waterworks Engineer, 33 and 35 French-street, Southampton.

Roads.

CANNOCK.—December 31st.—For the supply of refined tar prepared in accordance with the specification of the Road Board, for the urban district council.—Mr. R. Blanchard, engineer and surveyor, Council Offices, Cannock.

LYDD.—December 31st.—For the supply of 200 barrels of tar, for the corporation.—Mr. T. Kettle, borough surveyor

BRENTFORD.—January 1st.—For the supply of 12,000 gallons of distilled tar, for the urban district council.—Mr. J. W. Croxford, surveyor, Clifden House, Boston-road, Brentford.

BOLTON-UPON-DEARNE.—January 3rd.—For the execution of private street works, for the urban district council.—The Surveyor.

HOLLAND (Lincs).—January 3rd.—For the supply of 7,650 tons of broken granite, 1,095 tons of granite

chips, 250 tons of slag, 410 tons of coarse builders' sand, and 711 barrels of refined tar, for the county council.—Mr. W. H. Gane, clerk, Sessions House, Boston, Lincs.

NORTH RIDING.—January 5th.—For team labour and hauling, and macadam and steam rolling, for the county council.—Mr. W. G. Bryning, county surveyor, County Hall, Northallerton.

ISLE OF WIGHT.—January 5th.—For the supply of 150 tons of 1½-in. granite, for the rural district council.—The Surveyor, Newport, I.W.

DORSET.—January 7th.—For the supply of broken granite, basalt, quartzite, limestone, and tar-macadam, for the county council.—Mr. E. H. Habgood, acting county surveyor, County Offices, Dorchester.

BOURNE.—January 8th.—For the supply of 6,000 tons of granite and 2,000 tons of slag, for the rural district council.—Mr. T. Lake, district surveyor, Bourne, Lincs.

ELGIN.—January 11th.—For the supply of road metal for the county highways.—Mr. A. Hogg, county road surveyor, 24 Academy-street, Elgin.

BEXLEY.—January 11th.—For the supply of tar, highway materials, stoneware pipes, and Portland cement, for the urban district council.—Mr. W. T. Howse, surveyor, Council Offices, Bexley Heath.

DORKING.—January 15th.—For the supply of broken granite, tar, compo, sand, material for tarring, and 13,000 gallons of refined tar, for the urban district council.—Mr. W. A. Clegg, surveyor.

SURREY.—January 17th.—For the supply of high-class materials, such as granites, basalts, limestone, slag, tar-macadam, pitch, tar, tar oils, flints, fine gravel, haulage, and hire of steam rollers and water carts, for the county council.—Mr. A. Dryland, county surveyor, County Hall, Kingston-on-Thames.

MIDHURST.—January 18th.—For the supply of broken granite, for the rural district council.—Mr. A. G. Gibbs, surveyor, Council Offices.

SOMERSET.—January 21st.—For steam rolling and scarifying on main roads, for the county council.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

SOMERSET.—January 21st.—For the supply of broken granite or basalt, for the county council.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

WORCESTERSHIRE.—January 29th.—For the supply of granite, blast furnace slag and tar-macadam, for the county council.—Mr. C. F. Gettings, county surveyor, 30 Foregate-street, Worcester.

HERTS.—January 31st.—For the supply of hand-picked surface flints, dug gravel, hoggin, shingle, sand, and team labour, for the county council.—Mr. J. S. Killick, county surveyor, County Surveyor's Office, Hatfield.

Sanitary.

MERTHYR.—January 4th.—For the supply of disinfectants, for the corporation.—Medical Officer of Health, Town Hall.

NORTHWICH.—January 10th.—For the collection and removal of nightsoil and ashes, for the urban district council.—Mr. J. A. Cowley, clerk, Council House, Northwich.

Stores.

OTLEY.—December 31st.—For the supply of setts, kerbs, flags, granite macadam, pitch, tar, slag dust, tar-macadam, limestone macadam, and brushes, for the urban district council.—Mr. C. F. Hodgson, surveyor.

SUNDERLAND.—December 31st.—For the supply of street lamps, fire hydrants, road gullies, manhole covers, asphalting, kerbing, sanitary pipes, and disinfectants, for the rural district council.—The Surveyor.

HASTINGS.—January 3rd.—For the supply of manhole covers, brooms and brushes, for the corporation. Mr. P. H. Palmer, borough engineer, Town Hall.

BARNSLEY.—January 4th.—For the supply of materials and stores required in the highways and waterworks departments, for the corporation.—Mr. J. H. Taylor, Manor House Offices, Barnsley.

HAMPSTEAD.—January 6th.—For the supply of Yorkshire and other natural footway paving, artificial footway paving, granite kerb, channelling, wood blocks, broken granite, basalt, gravel, hoggin, Thames ballast, sand, pitch, tar, creosote oil, tar-paving, tar-macadam, lime, cement, drain pipes, traps, ironmongery tools, iron, steel, and slopping, for the borough council.—Mr. Arthur P. Johnson, town clerk.

ST. PANCRAS.—January 10th.—For the supply of cartage, timber and joinery materials, Jarrah wood blocks, barrows, trucks, handles, paints, oils, smiths' and founders' works, general ironmongery, tools and other hardware goods, Yorkshire stone and artificial paving slabs, granite kerbs, paving setts, broken granite, Kentish rag, gravel and other road materials, lime, cement, bricks, stoneware pipes and other glazed goods, bass brooms, horse brush stocks, tarpaulins, hemp and rubber goods, pitch, tar, creosote oil, removal of road sweepings, horsing water vans, and horsing road-sweeping and other machines, for the borough council.—Mr. Nisbet Blair, borough engineer and surveyor.

LANCASTER.—January 10th.—For the supply of brushes, ironmongery, iron, steel, iron and brass castings, team labour, and timber, for the corporation.—Borough Surveyor, Town Hall.

IRLAM.—January 14th.—For the supply of broken granite, tarred slag, kerbs, setts, pervious chippings, granite concrete flags, cement, stoneware pipes, disinfectants, scavenging brooms, and iron castings, for the urban district council.—Mr. R. H. Winterbottom, surveyor, Council Offices.

PLYMOUTH.—January 15th.—For the supply of paints, varnishes, ironwork, petroleum oil, broomheads, household brushes, rope, iron, steel, pitch-pine, deals, flooring, carbolic powder, Portland cement, lubricating oils, fuel oil, tar, pitch, painters' brushes, explosives, soap, softwood-blocks, creosote, disinfectant fluid, granite kerbs, setts, white lead, red lead, linseed oil, turpentine, turpentine substitute, refilling machine-revolving brooms, benzoline,

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motor spirit, tools, indiarubber goods, hose, and ship chandler's goods, for the corporation.—Mr. James Paton, borough engineer and surveyor, Municipal Offices, Plymouth.

HORNSEY.—January 17th.—For the supply of cartage, road materials, paving granite and general masons' materials, masons' and paviors' work, Portland cement, iron, steel, bituminous road materials, laying and maintaining asphalt footway and carriageway pavements, cartage, disposal of road sweepings, and street watering, for the corporation.—Mr. E. J. Lovegrove, borough engineer and surveyor, Town Hall.

ISLINGTON.—January 21st.—For the supply of stores for the electricity department.—Electrical Engineer, Lighting Station, Eden-grove, Holloway, N.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.
‡ Provisionally accepted.

ASHTON-UNDER-LYNE.—Accepted for the supply of one 100-gallon pneumatic ejector for humus sludge, for the corporation. Mr. J. Rowbottom:
Hughes & Lancaster, Ruabon and London.

LONDON. For installing heating apparatus at the county secondary school, Forest Hill, for the London County Council:

Beaven & Sons, Limited, Victoria-street	£2,127
J. Cormack & Sons, Limited, Westminster	2,122
Cannon & Hefford, Peckham	1,958
J. & F. May, Lincoln's Inn-fields	1,897
W. G. Cannon & Sons, Limited, London-road	1,820
Yetton & Brockett, Limited, Southwark	1,698
Brightside Foundry and Engineering Company, Limited, Victoria-street †	1,680

LONDON.—For the execution of tar-paving in educational institutions, for the London County Council:—
Chittenden & Simmons, Limited, Maidstone, Kent.
A. C. W. Hobman & Co., Limited, South Bermondsey.*
G. Neal, Tooting.
F. G. Sheppard, Peckham.
J. Smart & Son, Victoria-street.
J. Wainwright & Co., Limited, Maida Vale.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JANUARY.

5.—Institute of Sanitary Engineers: Presidential Address.
29.—Institution of Municipal Engineers: Northern District Annual Meeting.

FEBRUARY.

2.—Institute of Sanitary Engineers: Dr. Gilbert J. Fowler on "The Activated Sludge Process of Sewage Purification."

APPOINTMENTS WANTED.

CIVIL ENGINEER, Surveyor, 34, ineligible Army, experienced Railways, Bridges, Road Construction, Buildings, Drainage, Setting Out, Measuring up Works and Contracts, Book-keeping, desires permanent post.—Box 1,551, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (2,797)

APPOINTMENTS OPEN.

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BOROUGH OF MORECAMBE.
APPOINTMENT OF TEMPORARY BOROUGH SURVEYOR.

The Town Council of the Borough of Morecambe invite applications from qualified persons ineligible for military service for the temporary appointment of Borough Surveyor, as substitute for the Borough Surveyor on active service.

Applications, under seal, endorsed "Temporary Borough Surveyor," accompanied by three testimonials, and stating salary required, to be delivered to me not later than 3rd January, 1916.

WM. TILLY,
Town Clerk.

Town Hall, Morecambe. (2,801)

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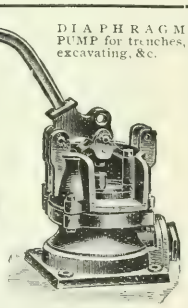
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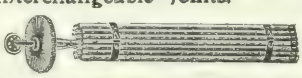

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